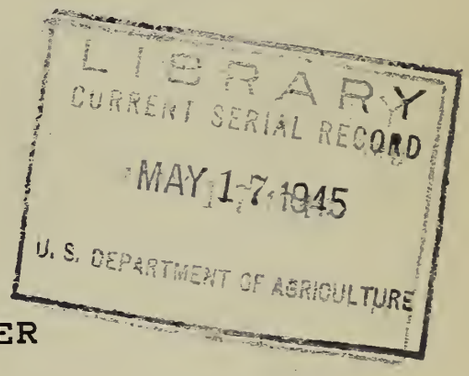
FARM CREDIT ADMINISTRATION
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

DELIVERY EFFICIENCY OF PETROLEUM COOPERATIVES AFFILIATED WITH SOUTHERN STATES COOPERATIVE, INC.



By

J. WARREN MATHER

COOPERATIVE RESEARCH AND SERVICE DIVISION

Miscellaneous Report No 35 A

February 1946

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM CREDIT ADMINISTRATION
WASHINGTON 25, D. C.
I. W. DUGGAN, GOVERNOR

COOPERATIVE RESEARCH AND SERVICE DIVISION

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The Cooperative Research and Service Division conducts research studies and service activities relating to problems of management, organization, policies, merchandising, sales, costs, competition, and membership arising in connection with the cooperative marketing of agricultural products and the cooperative purchase of farm supplies and services; publishes the results of such studies; confers and advises with officials of farmers' cooperative associations; and cooperates with educational agencies, cooperative associations, and others in the dissemination of information relating to cooperative principles and practices.

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CONTENTS

DELIVERY EFFICIENCY OF PETROLEUM COOPERATIVES AFFILIATED WITH SOUTHERN STATES COOPERATIVE, INC.

By J. Warren Mather
Agricultural Economist

With the increase in use of power-driven farm machinery and equipment in the South Atlantic States in recent years, farmers have become concerned with the problem of regular and efficient delivery service for needed motor fuels, oils, and greases. As a result, 17 local farmers' petroleum cooperatives have been organized since September 1938 in the States of Delaware, Maryland, Virginia, and West Virginia. They are affiliated with Southern States Cooperative, Inc., Richmond, Virginia, a regional wholesale purchasing association serving this 4-State area and Kentucky, which has been of much assistance in the development, financing, and management of the petroleum service.1/

These associations have made remarkable growth considering the conditions under which they have had to operate. They have encountered difficulties arising from growth; narrow margins; and wartime regulations involving scarcity of supplies and delivery equipment, tire and gasoline rationing, and turn-over of personnel. Nevertheless, their total volume reached almost 11 million gallons during the fiscal year ending June 20-30, 1944; patrons numbered almost 10,000; and a high degree of efficiency was attained. Representatives of these cooperatives, however, believe that there are many opportunities to further expand their services and improve their efficiency.

In connection with postwar planning activities, the director of Southern States' Petroleum Management Service requested the Cooperative Research and Service Division to make a study of 10 of its affiliated

Note: The author wishes to acknowledge the assistance and cooperation provided by managers and other employees of the associations surveyed, and by J. E. Givens, former director; W. E. Neale, director; E. J. Ruh, manager, Maintenance Division; R. J. Flanagan and J. T. Sturgill, district managers; and to Mrs. D. D. Marks, petroleum accountant, Petroleum Management Service, Southern States Cooperative, Inc. Appreciation for constructive suggestions is expressed to Joseph G. Knapp, Principal Agricultural Economist, and to John H. Lister, Senior Agricultrual Economist, Cooperative Research and Service Division. Credit is due also to Mrs. Grayce M. Collins of this Division for statistical analysis of the data.

1/ For a complete study of this wholesale see: Lister, John H., and Swantz, Alexander, "Purchasing Farm Supplies Through Southern States Cooperative, Inc." F.C.A. Cir. C-128. 150 pp., June 1943.

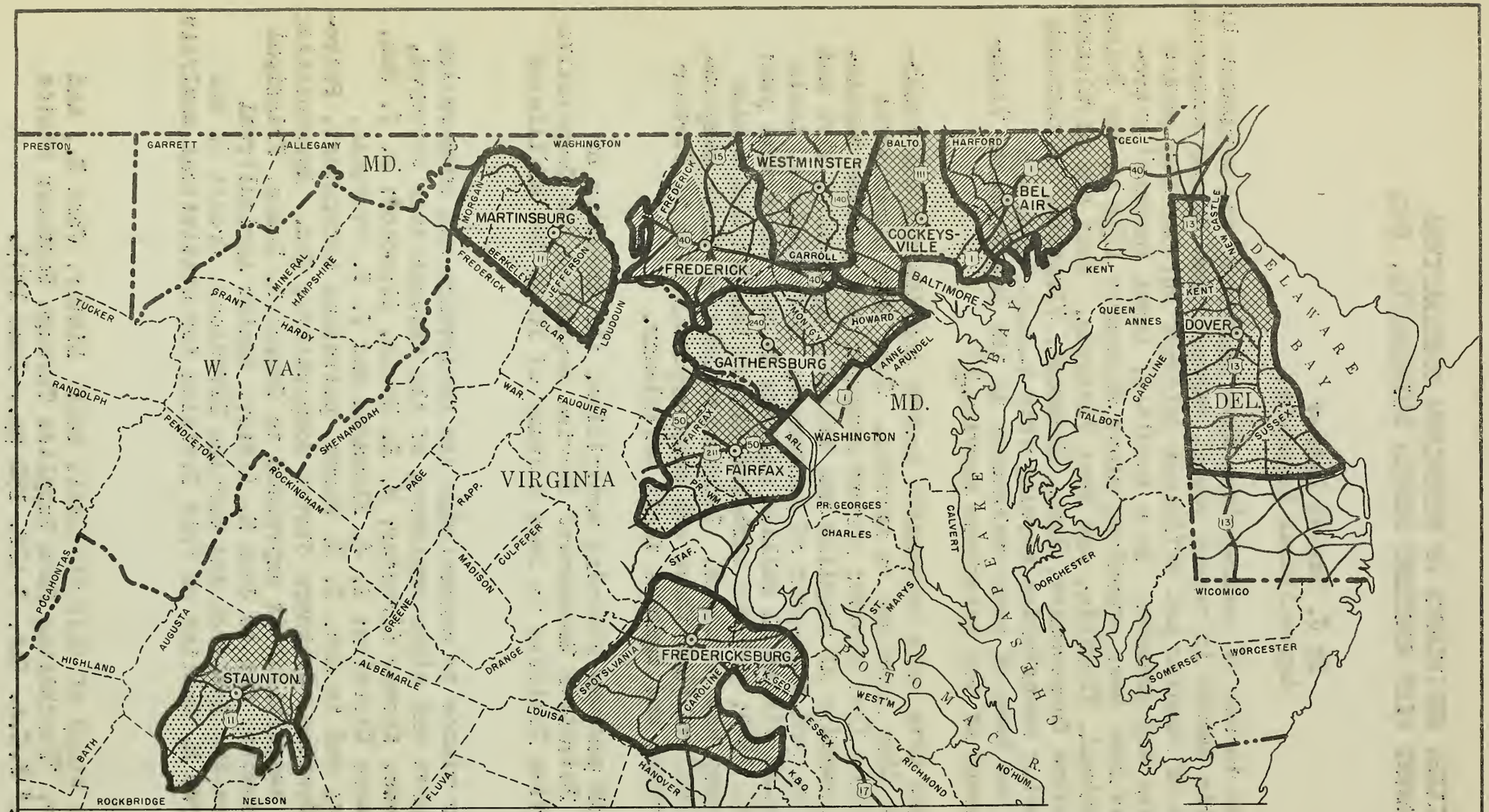

Figure 1. - Location of petroleum cooperatives surveyed and territories served by their farm servicemen, 1944.

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local petroleum associations, which were believed to be representative. Their locations and trade territories are shown in figure 1.

The objectives of the study were as follows: (1) to analyze the operating efficiency of the associations, and the performance and delivery costs of their tank trucks during the last 3 years; (2) to describe the delivery system and routing techniques used; (3) to determine changes in facilities and delivery equipment which should be made; (4) to analyze the annual purchases made by patrons who had farm-storage equipment loaned to them by the cooperatives, and to determine costs and standards for loaning such equipment; (5) to explore the possibilities for expanding the petroleum service; and (6) to obtain suggestions for developing a more efficient and complete postwar petroleum program. No attempt was made to obtain suggestions on educational programs, membership and employee relations, accounting procedures, or credit extension and control practices.

Approximately 1 day was spent at each association in 1944, interviewing the manager and other employees. Numerous records were analyzed including operating and financial statements and truck performance and cost records for the 3 fiscal years ending June 20-30, 1944. Also, patronage records on 6,295 patrons for the 1942-43 fiscal year were analyzed to determine the size of their annual purchases and the storage equipment loaned to them by the cooperatives.

BRIEF DESCRIPTION OF THE LOCAL ASSOCIATIONS

The associations at Gaithersburg and at Bel Air, Maryland, were formed in 1938 and 1939, respectively. Three of the others studies began operations in 1940 and five in 1941. All serve territories extending 20 to 25 miles in each direction from the bulk plant-an area of 1,300 to 2,000 square miles (see figure 1). Most associations had from two to seven competitors who delivered considerable volumes of motor fuel to farmers. Managers estimated that cooperatives were handling at the time of the study from 30 to 50 percent of the potential farm petroleum business in their territories.

These cooperatives are separately incorporated local farmers' associations. Each served from 382 to 1,064 patrons during the 1942-43 fiscal year, with an average of 630 patrons. Patronage refunds are paid to each producer-patron in preferred stock until members have provided enough capital to properly finance the business, subject to the discretion of the boards of directors. (The first $1 is applied on the purchase of a share of voting preferred stock.)2/ Such stock is redeemable by the holder at any time and is subject to call or retirement by the

2/ It is contemplated that future cooperatives will have $1 shares of voting common stock and $10 shares of nonvoting preferred stock, the latter to be used primarily as financing or investment stock.

association 10 years from date of issue. Nonproducers are paid refunds in cash each year. Borrowed funds are obtained from the wholesale, and during the association's early years they usually represented a large portion of the assets.

Each association had from three to six employees - a manager, one or more farm servicemen, and a part-time or full-time bookkeeper.3/ All were hired on a salary basis with the consent and advise of the Petroleum Management Service. In peacetime, the manager performs routine administrative duties, supervises credit extension and collection, contacts members and prospective members and patrons, conducts educational work, and supervises loaned equipment and routes. The board of directors of most associations is composed of seven members who serve 3-year terms. Directors must go off the board for 1 year before they can be re-elected for another term. Six directors are elected from the membership and one is appointed as a public director by the Director of Agricultural Extension in the State.

Volume of business per association, in 1943-44, ranged from 285,284 to 1,055,817 gallons of refined fuels consisting mostly of regular gasoline and some kerosene and fuel oil. All handled motor oil, greases, and small amounts of miscellaneous accessories or supplies. Some handled ethyl gasoline but none handled third-grade gasoline or distillate. A detailed analysis of volume is included in a later section of this report (see pp. 16 - 21)

Practically all refined fuels handled by these associations were delivered to farms by tank trucks. Therefore, the operations of the cooperatives were built around bulk plants and delivery systems. Most of the remaining fuel was purchased by livestock and milk haulers, and men who operated timber-sawing and rock-quarrying outfits. Delivery equipment was owned by all the associations. Much of the petroleum storage facilities on farms was owned by the cooperatives and loaned to farmers. Only the association at Bel Air, Maryland, had a service station as well as a bulk station. Small quantities of fuel were supplied to patrons through retail curb pumps at some of the bulk stations.

None of the associations had branch or sub-bulk plants; however, each had from 1 to 10 cooperative service agencies (formerly called "private or dealer agents") and 1 or more Southern States' service (feed and supply) stores in its territory who acted as resellers of motor fuels. These agencies usually had a 550- or 1,000-gallon tank equipped with a curb pump from which fuel was retailed.

A few individual farmers acted as agencies, only one of whom performed delivery service to other nearby farmers. Patronage refunds were paid paid by the local petroleum cooperative to these farmer resellers on fuel

3/ The standard terminology of these cooperatives included "farm servicemen" which corresponded to "truck operators," "truck salesmen," and "petroleum deliverymen or servicemen" in associations located in other sections of the country.

used by them. Each cooperative service agency and store operator on an established margin and at the end of the fiscal year, the dollar volume of each patron's purchases, including petroleum products, feed, seed, and other supplies, is forwarded to the central office of Southern States Cooperative at Richmond, Virginia. In the case of the service agency, wholesale patronage refunds at the rate declared on all business are paid directly to the member-patrons from Richmond in common stock of Southern States Cooperative. No refunds are paid from local earnings of the agency. In the case of the service stores, their members receive patronage refunds which are based upon the total of the local cooperative's savings and the wholesale refunds paid to the stores in preferred stock.

The local petroleum cooperatives obtain their supplies through Southern States Cooperative. Refined fuels are purchased direct from commercial refiners and delivered to the wholesale at port terminals of supplying companies. From there the commodities are delivered to local bulk plants by rail tank-car shipments, by the wholesale's transports, or by contract haulers.

This wholesale has membership in United Cooperatives, Inc., Alliance, Ohio, a federation of regional cooperatives, and buys its oil requirements through United's oil blending plants. Other supplies are obtained through United's master contracts with commercial firms.

Local petroleum cooperatives receive the same rate of patronage refund from the wholesale as all other service stores or independent cooperatives. This rate was 4 percent on dollar volume in 1943-44.

ECONOMIC FACTORS AFFECTING THE PETROLEUM SERVICE

Agricultural Characteristics of the Area Served

Size and density of farms, type of agriculture, the degree of mechanized farming, and the number of trucks and automobiles on farms are important factors affecting the volume handled by petroleum cooperatives and efficiency of delivery operations.

In the areas served by the 10 petroleum cooperatives selected for study, about two-thirds of all land was devoted to farming as reported in the 1940 Census (see Appendix, table 26). About one-third of all land was classified as cropland, although the range was from 13 to 56 percent in the different counties. There were from 3 to 5 farms per square mile in most counties, except in northern Maryland where there were from 5 to 7; thus farms averaged 98 acres in size with the range from 64 to 142 acres.

General and dairy farming predominated in the areas served by these 10 cooperatives. Poultry production was heavy in some counties with Delaware and the eastern shore of Maryland noted for commercial broilers. Considerable income was received from vegetables and truck crops in Maryland - particularly around Baltimore. The West Virginia counties studied were in the Shenandoah Valley where fruit and mixed farming was

Table 1. - Tractors, trucks, and automobiles on farms, and average value of machinery and implements per farm on April 1, 1940; and farm expenditures for gasoline, kerosene, distillate, and oil in 1939 in selected counties of four South Atlantic States

State and county a/	Tractors on farms	Tractors per 100 farms		Tractors per square mile of all land	Trucks per 100 farms	Automobiles per 100 farms	Average value of machinery and implements per farm	Farm expenditures for petroleum products in 1939	
		On all farms	On farms of 30 acres or more b/					Per farm	Per square mile of all land
Delaware:									
*Kent	908	33	41	1.5	24	87	$794	$87	$199
New Castle	723	46	63	1.7	48	105	1,299	152	241
Sussex	1,030	22	29	1.1	25	88	647	176	181
Maryland:									
*Harford	759	34	46	1.7	32	109	716	130	316
Cecil	496	34	45	1.4	33	94	849	150	237
*Baltimore	919	25	47	1.5	44	111	619	155	350
*Carroll	871	27	38	1.9	35	109	662	95	307
*Frederick	836	24	33	1.3	27	109	807	98	264
*Montgomery	445	22	35	0.9	27	93	830	169	180
Howard	271	27	34	1.1	35	104	837	98	186
West Virginia:									
*Berkeley	260	20	28	0.8	34	91	461	121	177
Jefferson	231	27	35	1.1	28	110	749	118	249
Virginia:									
*Fairfax	298	20	35	0.7	29	93	612	118	154
Prince William	157	15	22	0.5	15	62	550	91	76
*Spotsylvania	155	12	16	0.4	15	70	345	53	65
Stafford	130	15	20	0.5	19	86	278	57	75
Caroline	142	8	11	0.3	10	56	311	48	35
King George	84	10	15	2.1	12	57	319	51	119
*Augusta	497	13	22	0.5	15	87	556	72	85
Total or average	9,212	23	34	1.0	27	93	$661	$111	$185

a/ Counties marked with an asterisk are those in which the headquarters of the petroleum cooperatives are located. The counties not so marked are those into which the trade territories of the cooperatives also extend.

b/ Total tractors in counties and number of farms of 30 acres or more in size were used in the computations.

Source of data: 1940 U. S. Census of Agriculture.

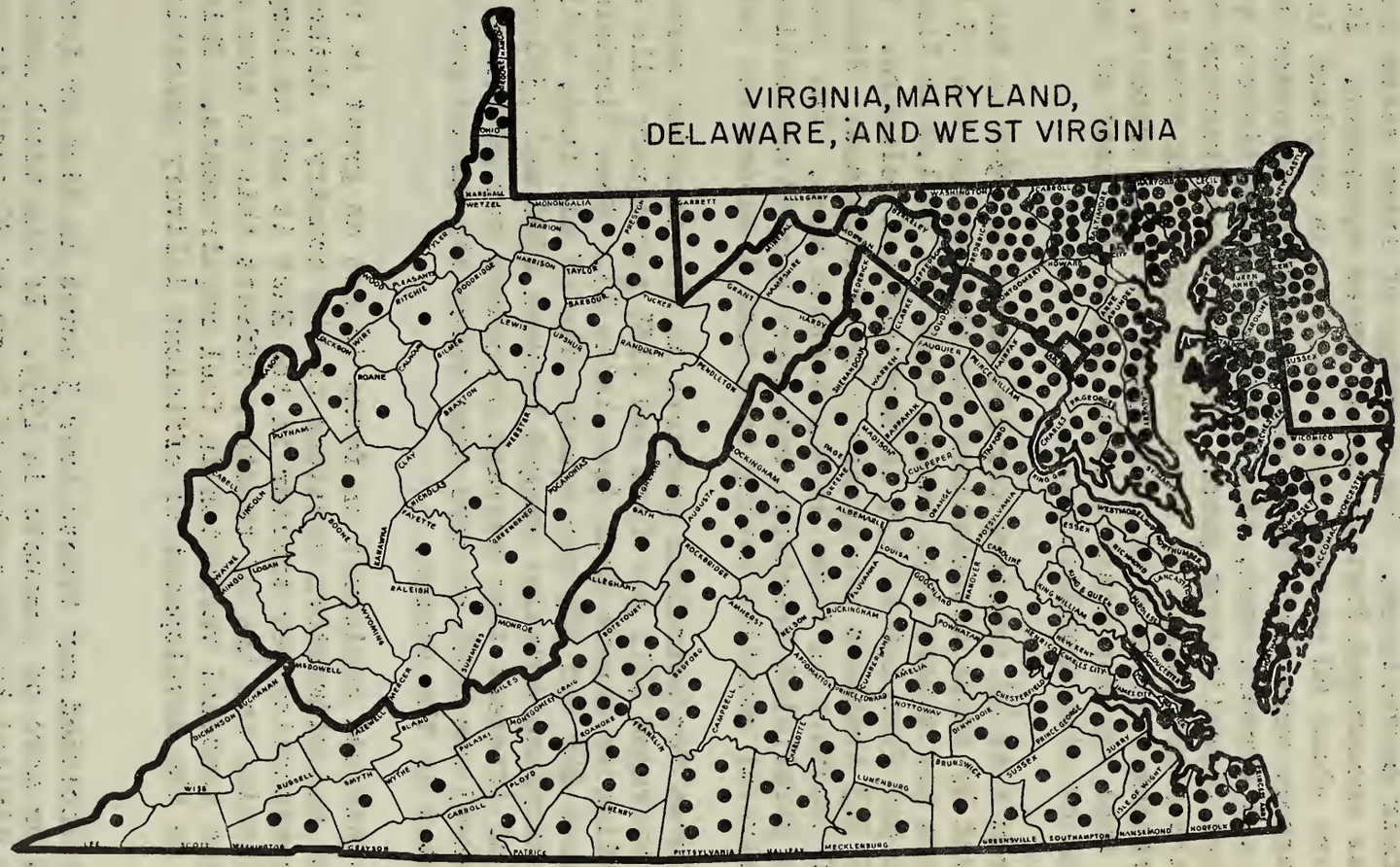

Figure 2. – Number of tractors on farms, by counties, April 1, 1940.

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prevalent. In 1939, corn production in the counties served by the 10 cooperatives was about 2 1/2 times that of wheat and 7 times that of barley. Oats and rye production was relatively small. In such Maryland counties as Harford and Cecil, a considerable acreage was grown of alfalfa, soybeans, sweet corn, and tomatoes.

The use of motorized equipment on farms has been increasing in recent years. Many small farms have obtained small all-purpose type tractors because of their convenience. The shortage of labor since the beginning of the war has encouraged further use of power equipment. It is estimated that there were about 60 percent more tractors in Maryland in 1944 than in 1940. Tractors were used for a wide variety of purposes in the area-general crop and orchard work, silo filling, sawing timber, quarrying rock, and other miscellaneous jobs. In many cases tractors were used practically the year round. In the poultry producing areas large quantities of kerosene were used by poultrymen in their brooders. Some farmers used fuel oil for heating their homes, but most of this business was with urban or city populations.

There were from 8 to 46 tractors per 100 farms in 1940 in the different counties served by these associations and the average was 23 (see table 1).4/ Tractors per square mile ranged from 0.4 to 1.0 in Virginia and West Virginia and from 1.0 to 1.9 in Maryland and Delaware. There were an average of 3.3 tractors per square mile of cropland. Figure 2 shows the number of tractors on farms in the 4-State area. The number of trucks almost paralleled tractors, but there were 93 automobiles per 100 farms, with several counties having more than 1 automobile per farm.

Farm expenditures for petroleum products in the counties served by the Cooperatives averaged $111 per farm and $185 per square mile of all land in 1939 according to Census data (see table 1). Some Virginia counties averaged between $65 and $85 per square mile of all land, while Delaware and northern Maryland counties ranged between $300 and $350 per square mile. It is of interest that average purchases per patron of the cooperatives in 1942-43 was $228 or more than twice the amount per farm in 1939 as reported in the Census.

The use of mechanized equipment on farms is not as great in this area as in the central and midwestern sections of the country. Although the annual fuel consumption per tractor in the East is not as large, the more diversified farming and use of tractors offsets this to some extent and results in less seasonal variation in fuel requirements. This situation is favorable to the development of efficient delivery operations.

4/ Such farms included any tracts over 3 acres in size or from which was produced $250 or more of products in 1939. If the total number of tractors were divided by the number of farms of 30 acres or more in size, the range would be from 16 to 63 and the average 34.

Topography and Road Systems

The topographical features of the area and the type of road system greatly influence the size of delivery equipment that can be used and the extent that trucks are prevented from making deliveries during bad weather. Most of the area served by these associations is quite rolling to hilly. However, the territories served by the cooperatives at Dover, Delaware and Bel Air, Maryland are fairly level, while some sections of the areas served by the cooperatives at Frederick, Maryland; Martinsburg, West Virginia; and Staunton, Virginia are mountainous.

Improved roads radiate in all directions from the cities in which these cooperatives are located. In many counties, roads follow valleys and ridges, and the lack of cross roads causes a considerable amount of backtracking by trucks. The 1940 Census of Agriculture reported that 60 percent of the roads bounding farms in the areas were hard-surfaced or gravelled, with the variation in counties from 32 to 91 percent (see Appendix, table 26). Trucks receive rather hard use on many of the unimproved roads. Lanes into the farmsteads often are in poor condition, especially during the winter and early spring. This condition causes a great deal of trouble and expense to the associations in making deliver - ies which the managers feel could be largely eliminated by a farm lane improvement program. It was suggested that cooperative employees could do much to encourage farmers to improve their lanes; that employees assist farmers in lining up the use of county or township grading equip- ment; and that each cooperative might own a rock crusher and grading machinery for the use of patrons.

Size of Annual Purchases by Individual Patrons

The dollar volume of purchases by patrons, exclusive of service agencies and stores, of the 10 associations was analyzed for the fiscal year ending June 20-30, 1943.5/ Purchases were classified into groups each having a range of $100 in amount (see table 2). There were, on the average, 624 patrons per association and they purchased an average of $152 worth during 1942-43. The average purchases per patron in each association were as follows:

Martinsburg, W. Va.	- $206	Fredericksburg, Va.	- $152
Cockeysville, Md.	- 185	Staunton, Va.	- 142
Westminster, Md.	- 174	Dover, Del.	- 139
Gaithersburg, Md.	- 163	Bel Air, Md.	- 139
Frederick, Md.	- 153	Fairfax, Va.	- 109

5/ The standard terminology of these cooperatives included "patrons' purchases" which corresponded to "sales," "patrons' deposits," and "merchandise furnished at provisional prices" in associations located in other sections of the country.

Table 2 - Average annual dollar purchases, by size groups, by patrons of 10 petroleum cooperatives during the fiscal year ended June 20-30, 1943 (exclusive of service agencies and stores)

Grouping of annual dollar purchases per patron	Patrons per association making specified purchases		Dollar purchases by patrons per association c/		
	Total	Percentage of total	Amount	Percentage of total	Average per patron
	Number	Percent	Dollars	Percent	Dollars
Less than $100 a/....	348	55.7	12,546	13.2	36
$100-$199.....	116	18.6	16,736	17.7	144
$200-$299.....	75	12.0	18,212	19.2	243
$300-$399.....	37	6.0	12,925	13.6	349
$400-$499.....	18	2.8	7,842	8.3	436
$500 and over b/.....	30	4.9	26,457	28.0	882
Total.....	624	100.0	94,718	100.0	152
a/ $0-$24	164	26.3	2,034	2.1	12
b/ $1,000 and over	6	1.0	10,482	11.1	1,747

c/ Excludes purchases by service agencies and stores, transfers to other cooperatives, and fuel used in associations' own trucks averaging $12,304 per association. Also, excludes $52,441 of products supplied to the Augusta Farm Bureau Cooperative Association, Staunton, Virginia. Including all the above, the average volume per association was $112,266.

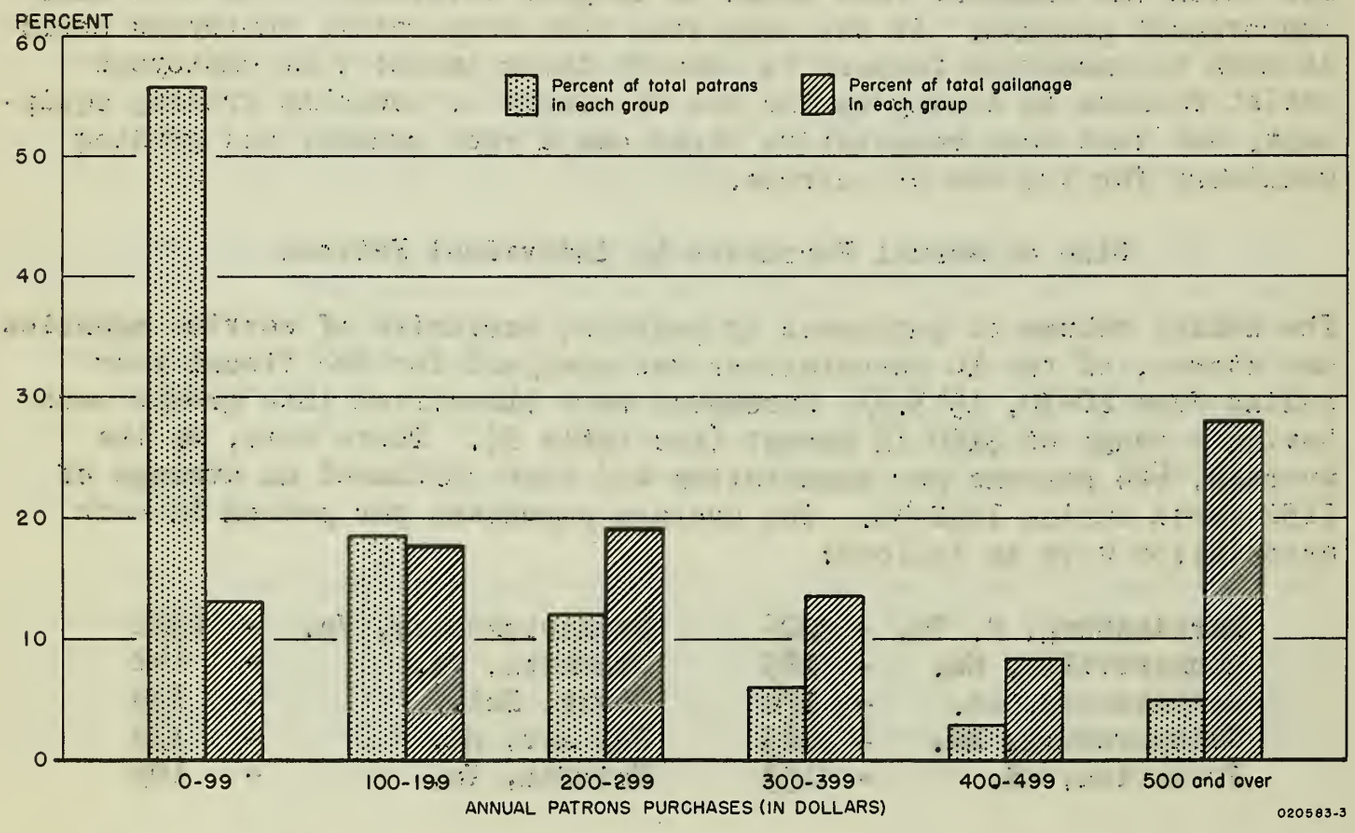


Figure 3. - Average dollar purchases by patrons of 10 petroleum cooperatives during the fiscal year ended June 20-30, 1943. (Exclusive of service agencies and stores.)

The large number of fuel oil patrons at Fairfax, Virginia, accounted for the low volume per patron in this association. The distribution of annual purchases by patrons was quite uniform among the 10 associations studied (see figure 4). A characteristic of all associations was that more than one-half (55.7 percent) of their patrons each purchased less than $100 worth of products during the year. This group purchased only 13.2 percent of the total volume (see table 2 and figure 3). Upon further analysis it is noted that slightly more than one-fourth of the total patrons each purchased less than $25 worth of products during 1942-43. Their volume represented only 2.1 percent of the total. These patrons should be carefully checked each year to determine whether more patronage could be obtained from them and to see that no extra mileage is being driven in serving them. At the other extreme, only 5 percent of the patrons purchased more than $500 worth of fuel, but their volume constituted 28 percent of the total. There were, however, 2 patterns among the large-volume patrons. In the associations at Cockeysville and Gaithersburg, Maryland; Martinsburg, West Virginia; and Fredericksburg, Virginia, the volume of a small number of patrons (3-8 percent) represented about 40 percent of the total; while in the other 6 cooperatives, a similar small group accounted for 20-25 percent of the total dollar volume.

The distribution of patrons in the four volume groups ranging from $100-$499 per year was similar in all associations. The proportion of the volume of business in each group was similar for all cooperatives with the exception of those at Fredericksburg, Staunton, and Fairfax, Virginia, where more of the volume was in the $100-$199 group than in the $200-$299 group.

Figure 5 shows a distribution of the gallons of gasoline, kerosene, and fuel oil purchased in 1942-43 by patrons of designated associations. The largest percentage of patrons purchased less than 500 gallons of gasoline and fuel oil. Most of the volume was in the two groups ranging between 500 and 1,500 gallons. The average quantity of gasoline and fuel oil purchased per patron during the year was 1,037 and 715 gallons, respectively, for the two associations. Almost two-thirds of the kerosene patrons purchased less than 200 gallons each in 1942-43. One-half of the volume was taken by 31 percent of the patrons purchasing between 200 and 600 gallons. The average purchase per patron was 210 gallons for the year.

These data indicate the importance of a relatively few large patrons in acquiring and maintaining a large volume of business in each association. Furthermore, the data show that these cooperatives were serving the small as well as the large users of petroleum products. This is an important fact to remember in evaluating delivery costs and efficiency of operation and in realizing the necessity of operating well-organized routes. However, the patronage or loyalty of some of these small patrons might be increased and mileage in serving them reduced by making larger deliveries and thus fewer trips to their farms.

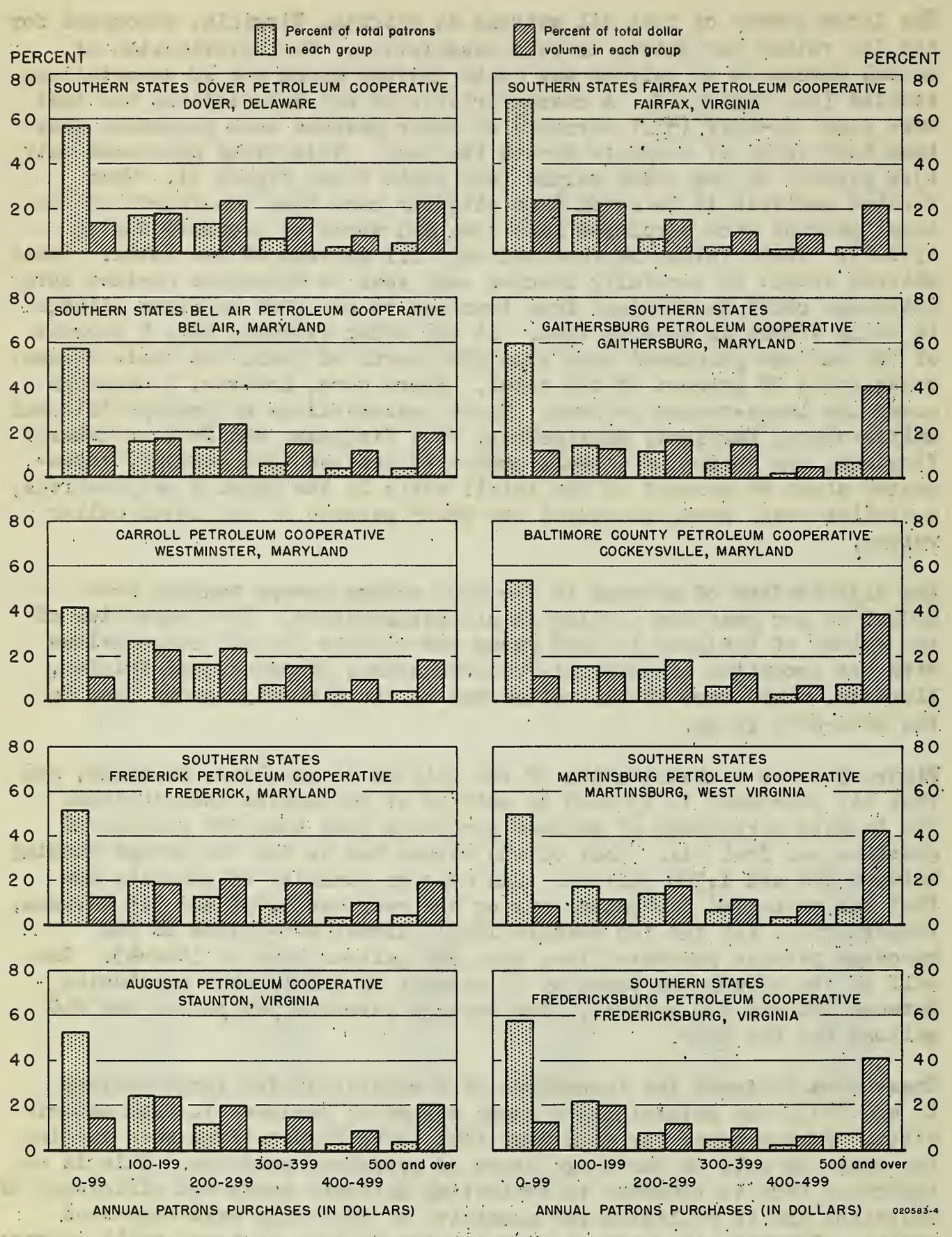


Figure 4. - Average dollar purchases by patrons of each of 10 petroleum cooperatives during the fiscal year ended June 20-30, 1943. (Exclusive of service agencies and stores.)

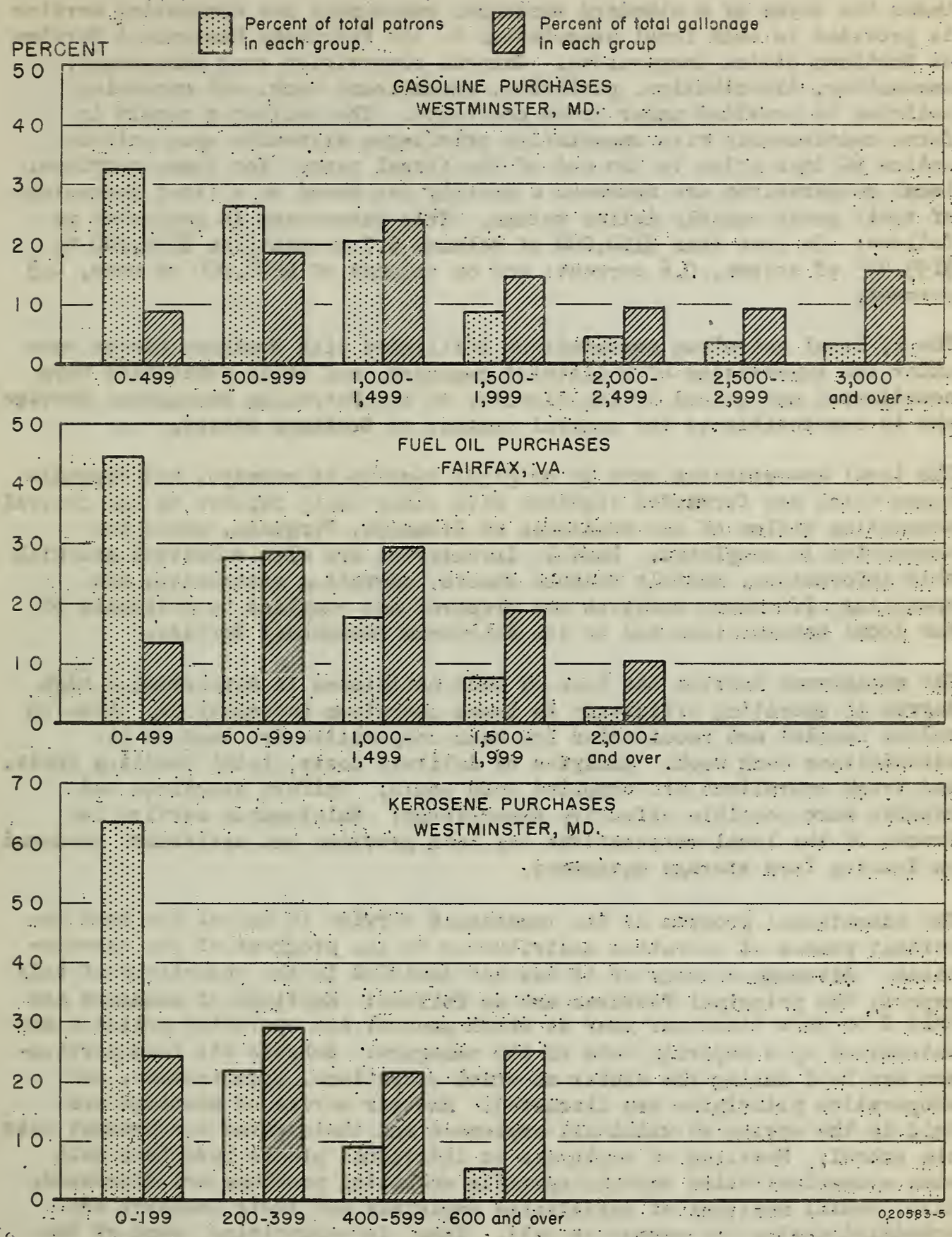


Figure 5. - Fuel purchased by patrons of designated cooperatives during the fiscal year ended June 20, 1943.

Management and Accounting Service Provided by the Wholesale

Under the terms of a standard contract, management and accounting service is provided to each local association by the Petroleum Management Service of Southern States Cooperative. General supervision over management, accounting, distribution, publicity, educational work, and operating policies is provided under these contracts. The contracts remain in force continuously with cancelation privileges allowable upon written notice 60 days prior to the end of the fiscal year. For these services, local cooperatives are assessed a monthly fee based on a fixed percentage of their gross monthly dollar volume. This percentage is graduated as follows: On less than $100,000 of volume, 0.7 percent; on $100,000 to $199,999 of volume, 0.6 percent; and on volumes of $200,000 or more, 0.5 percent.

The 17 local petroleum associations affiliated with Southern States were under the supervision of 2 district managers, and their activities were coordinated and guided by the director of the Petroleum Management Service who is responsible to the general manager of Southern States.

The local associations make up original records of receipts and expenditures which are forwarded together with other daily reports to the central accounting office of the wholesale at Richmond, Virginia, where the accounting is completed. Monthly inventories are also submitted and with this information, monthly balance sheets, operating statements, and operating efficiency analyses are prepared and supplied to officials of the local associations and to the Petroleum Management Service.

The management service has been of much assistance in developing a high degree of operating efficiency in these petroleum associations. Data on volume handled and receivables for each cooperative are sent to all associations each week. Analyses of delivery costs, total handling costs, and truck operations are compiled each month. Uniform practices and records make possible effective comparisons. Maintenance service for trucks of the local cooperatives has been provided and assistance rendered on loaning farm storage equipment.

The educational program of the management service is one of the most important phases of operation contributing to the progress of the associations. Although a study of it was not included in the objectives of this report, the principal features are as follows: Meetings of managers are held 2 or more times per year at which general and operating policies are determined by a majority vote of the managers. Schools for farm servicemen are held during the winter at which operations, organization, and cooperative principles are discussed. Another series of meetings are held in the spring at which all employees and their wives are brought into the school. Meetings of employees at individual plants have been held once a month at which certain specific operating problems are discussed. Also, social meetings of association employees and their families are scheduled during the summer or fall. Thus, in summarizing much of the success of these cooperatives has been due to the management service which is provided in a democratic manner. Under such a system, however, it is important that more educational work of this type be conducted among the boards of directors so that they may have a better understanding of the business and of their responsibilities.

EFFICIENCY OF DELIVERY OPERATIONS, 1941-42 to 1943-44

The costs of delivering fuel from bulk stations to farms constitutes a large proportion of the total handling costs of farm petroleum cooperatives. Usually there are more opportunities to reduce delivery costs than overhead costs. To analyze delivery efficiency it is necessary that detailed records be kept on the performance of each tank truck and its operator. Such records were maintained on a rather complete and uniform basis by all associations as the accounting was under the supervision of the Petroleum Management Service of the wholesale.

Operations of trucks as shown in table 3 were listed under the code number of the truck or trucks serving a specified farm serviceman's territory the entire year. Thus, where two trucks are shown together, they are equivalent to one full-time truck for the territory as they were generally in use at different periods of the year. Also, two different men may have served the territory during the year.

Annual Volumes Delivered and Mileages Driven by Trucks

Data on the gallonage of refined fuels and motor oil delivered by each of 16 trucks during the fiscal year ending June 20-30, 1942, and by 22 trucks during the years ending June 20-30, 1943 and 1944, are included in table 3. The average annual volumes delivered per truck by years were: 314,479 gallons in 1941-42; 284,986 gallons in 1942-43; and 308,441 gallons in 1943-44, equivalent to 25,703 gallons per month; 5,932 per week; and 988 gallons per day. The median in 1943-44 was 305,949 gallons. The 5 low trucks each delivered less than 260,000 gallons while the 5 high trucks each delivered more than 345,000 gallons. Only 1 truck devoted its operations primarily to fuel oil; in 1944 it delivered 443,096 gallons of all fuels. The largest volume delivered by any truck during the 3-year period was 456,514 gallons; and its high week was 53,000 gallons. (It did not handle fuel oil.) The lowest volume of any truck during the period was 171,109 gallons. A frequency distribution of the volumes is shown in table 4. Figures 6 to 8 show annual and monthly gallonages delivered per truck by years.

Although each of 7 trucks had smaller volumes and 9 had larger ones in 1942-43 than in 1941-42, the average volume per truck was 9.4 percent under that of 1941-42 mainly because 6 full-time trucks were added to serve approximately the same territories of the cooperatives. As a result, the average mileage per truck was reduced 17.8 percent. Volume within the revised territories was then increased 8.2 percent in 1943-44 over 1942-43. Fourteen of the 22 trucks showed increases in 1943-44.

These annual volumes per truck are exceedingly high considering the extent of power farming in the area; the size of truck tanks; and the large number of small patrons. Many farm servicemen had about all the business they could handle in 1943-44. As a standard, it appears that trucks in this area should deliver at least 275,000 gallons annually since all except 5 exceeded this volume in 1943-44.

Table 3. - Annual gallonage delivered, mileage driven, and "gallons delivered per mile driven" by tank trucks during fiscal years ended June 20-30, 1942-44 a/

Location of cooperative and truck code number	Year ending June 20-30	Gallonage delivered per truck		Mileage driven per truck		Gallons delivered per mile driven	
		Annual total	Percentage change over prior year	Annual total	Percentage change over prior year	Annual average	Percentage change over prior year
		Gallons	Percent	Miles	Percent	Gallons	Percent
Dover, Del.:							
15	1942	374,773	-	27,729	-	13.5	-
15	1943	267,419	- 28.6	16,671	- 39.9	16.0	18.5
15	1944	297,013	11.1	15,758	- 5.5	18.8	17.5
30	1942	b/ 80,100	-	5,638	-	14.2	-
30	1943	304,575	-	20,766	-	14.7	-
30-26 c/	1944	318,069	4.4	23,150	11.5	13.7	- 6.8
Bel Air, Md.:							
3	1942	311,055	-	16,902	-	18.4	-
3	1943	282,939	- 9.0	14,398	- 14.8	19.6	6.5
3-42	1944	306,207	8.2	15,147	5.2	20.2	3.1
31	1942	d/102,303	-	4,730	-	21.6	-
31	1943	352,936	e/ 3.0	18,838	e/ 3.9	18.7	- 1.1
31	1944	346,270	- 1.9	19,441	3.2	17.8	- 4.8
4	1942	342,581	-	18,134	-	18.9	-
Cockeysville, Md.:							
19	1942	328,908	-	16,944	-	19.4	-
19	1943	292,928	- 10.9	14,630	- 13.7	20.0	3.1
19	1944	220,175	- 24.8	10,892	- 25.6	20.2	1.0
23	1942	253,686	-	18,737	-	13.5	-
23	1943	295,433	16.5	16,672	- 11.0	17.7	31.1
23-37	1944	305,689	3.5	13,899	- 16.6	22.0	24.3
26	1942	b/ 60,104	-	3,582	-	16.8	-
26	1943	171,109	-	11,583	-	14.8	-
26-38	1944	257,971	50.8	15,149	30.8	17.0	14.9
Westminster, Md.:							
4	1943	f/237,381	-	12,946	-	18.3	-
4	1944	282,852	19.2	13,301	2.7	21.3	16.4
17	1942	319,730	-	19,826	-	16.1	-
17	1943	274,826	- 14.0	13,828	- 30.3	19.9	23.6
17	1944	345,030	25.5	16,101	16.4	21.4	7.5
22	1942	303,676	-	17,773	-	17.1	-
22	1943	332,188	9.4	14,769	- 16.9	22.5	31.6
22-37	1944	286,868	- 13.6	15,361	4.0	18.7	- 16.9
Frederick, Md.:							
16	1942	273,752	-	22,141	-	12.4	-
16	1943	305,067	11.4	20,453	- 7.6	14.9	20.2
16	1944	323,929	6.2	19,926	- 2.6	16.3	9.4
32	1942	d/ 50,043	-	4,850	-	10.3	-
32	1943	232,562	-	17,351	-	13.4	-
32	1944	326,564	40.4	18,208	4.9	17.9	33.6
Gaithersburg, Md.:							
1	1942	295,005	-	13,008	-	22.7	-
1	1943	316,521	7.3	13,767	5.8	23.0	1.3
1	1944	296,604	- 6.3	13,050	- 5.2	22.7	- 1.3
2	1942	286,489	-	19,610	-	14.6	-
2	1943	308,104	7.5	18,974	- 3.2	16.2	11.0
2-37	1944	385,736	25.2	19,359	2.0	19.9	22.8

Table 3. - continued

Location of cooperative and truck code number	Year ending June 20-30	Gallonage delivered per truck		Mileage driven per truck		Gallons delivered per mile driven	
		Annual total	Percentage change over prior year	Annual total	Percentage change over prior year	Annual average	Percentage change over prior year
		Gallons	Percent	Miles	Percent	Gallons	Percent
Martinsburg, W. Va.:							
6	1942	456,514	-	23,232	-	19.6	-
6	1943	306,748	- 32.8	14,192	- 38.9	21.6	10.2
6	1944	323,308	5.4	13,776	- 2.9	23.5	8.8
34	1942	b/ 93,738	-	4,746	-	19.8	-
34	1943	328,743	-	15,816	-	20.8	-
33	1944	317,938	- 3.3	10,678	- 32.5	29.8	43.3
Fairfax, Va.:							
5	1942	395,718	-	23,040	-	17.2	-
5	1943	201,255	- 49.1	10,786	- 53.2	18.7	8.7
5	1944	258,778	28.6	15,218	41.1	17.0	- 9.1
13	1942	324,799	-	18,625	-	17.4	-
13-35	1943	338,102	4.1	14,383	- 22.8	23.5	35.1
35	1944	443,096	31.1	13,005	- 9.6	34.1	45.1
27	1943	333,725	-	13,687	-	24.4	-
27-39	1944	275,324	- 17.5	13,293	- 2.9	20.7	- 15.2
Fredericksburg, Va.:							
18	1942	321,667	-	20,677	-	15.6	-
18	1943	310,987	- 3.3	18,485	- 10.6	16.8	7.7
18	1944	365,773	17.6	23,937	29.5	15.3	- 8.9
Staunton, Va.:							
20	1942	242,614	-	16,438	-	14.8	-
20	1943	247,644	2.1	14,328	- 12.8	17.3	16.9
20	1944	246,149	- 0.6	13,532	- 5.6	18.2	5.2
24	1942	200,689	-	12,490	-	16.1	-
24	1943	236,521	17.9	18,097	44.9	13.1	- 18.6
24	1944	235,568	- 0.4	16,492	- 8.9	14.3	9.2
Averages:							
16 trucks	1942	314,479	-	19,082	-	16.5	-
22 trucks	1943	284,986	- 9.4	15,678	- 17.8	18.2	10.3
22 trucks	1944	308,441	8.2	15,885	1.3	g/ 19.4	6.6

a/ Trucks designated as "extras" in records were excluded.
b/ Covers only last 3 months' operations; not included in average.
c/ Wherever 2 trucks are indicated for a territory in this table, they are equivalent to one regular truck as they usually were used at different times during the year.
d/ Covers only last 4 months' operations; not included in average.
e/ Compared with truck 4, which operated in same territory during 1942.
f/ Does not include 45,141 gallons delivered and 2,111 miles driven at Bel Air before truck was transferred to Westminster.
g/ This average was 17.5 percent above that in 1942.

Table 4 - Frequency distribution of annual volumes delivered by tank trucks, 1941-42 to 1943-44

Volumes delivered	Number of tank trucks delivering specified volumes		
	1941-42	1942-43	1943-44
Less than 200,000 gallons	0	1	0
200,000 - 249,999 gallons	2	5	3
250,000 - 299,999 gallons	4	5	7
300,000 - 349,999 gallons	7	10	9
350,000 - 399,999 gallons	2	1	2
400,000 and over gallons	1	0	1
Total	16	22	22

The average mileages driven per truck in specified territories by years were as follows: 1941-42, 19,082 miles; 1942-43, 15,678; and 1943-44, 15,885 miles (see table 3). As already mentioned, mileage in 1942-43 was reduced 17.8 percent under that for 1941-42 by reducing the average territory served through the addition of 6 trucks. Thirteen of the 16 trucks drove fewer miles in 1942-43 than the previous year. Mileage in 1943-44 averaged approximately the same as in 1942-43, although 11 of the 22 trucks showed reductions.

The range in mileage per truck in 1943-44 was from 10,678 to 23,937. Seven trucks drove between 13,000 and 15,000 miles each and seven drove between 15,000 and 17,000 miles. The annual average of 15,885 was equivalent to 1,324 miles per month; 305 per week; or 51 miles per day. Travel was reduced by covering smaller territories; by planning routes more carefully; by covering routes every 3 or 4 weeks in the winter; by eliminating call-backs; and by encouraging minimum deliveries of 25 gallons. Figures 6 to 8 show annual and monthly mileages driven per truck by years.

Gallons Delivered Per Mile Driven

A simple measurement of the efficiency with which motor fuel is moved from bulk stations to farms by tank trucks is the "gallonage delivered per mile driven." As shown by figure 9, there is a close relationship between this ratio and delivery costs per gallon of fuel. Such costs decreased about one-tenth of a cent per gallon with each 2 miles increase in "gallons delivered per mile of travel." It is especially useful for measuring the delivery performance among trucks in this study because of the uniformity in type of associations, delivery equipment, routing system, farm storage, and various operating conditions. (If a very large proportion of the fuel is delivered to service stations or re-sellers then "gallons delivered per mile" should be computed on it and on farm deliveries separately.)

In computing "gallons delivered per mile," fractional units should not be disregarded. For example, an increase from 15.0 to 18.0 gallons per mile is a 20 percent improvement, while an increase from 15.5 to 18.0 gallons is a 16.1 percent change. Furthermore, it should be kept in mind that if volume is increased 25 percent on the same mileage, the

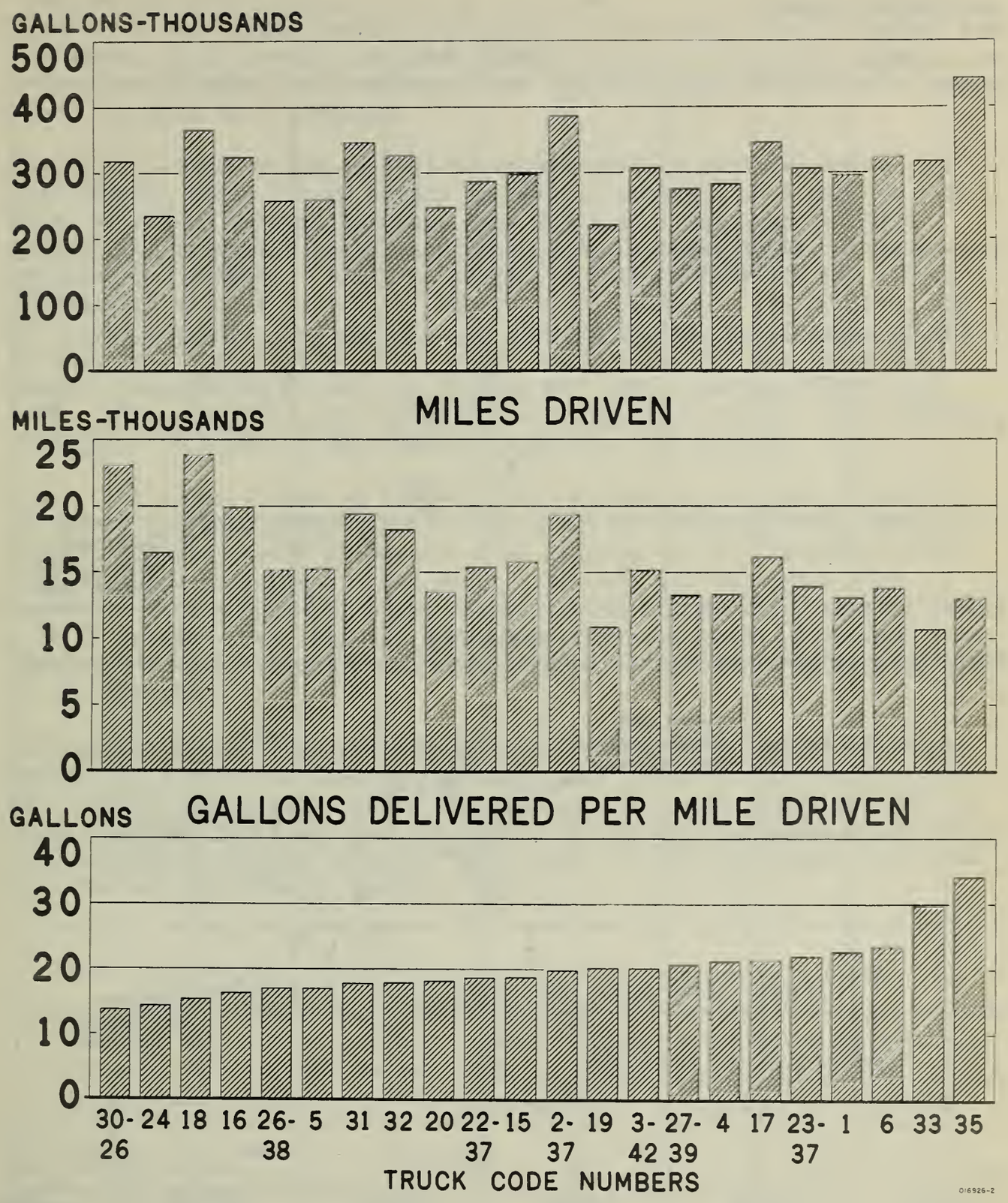


Figure 6. - Annual delivery operations of 22 tank trucks for fiscal year ended June 20-30, 1944.

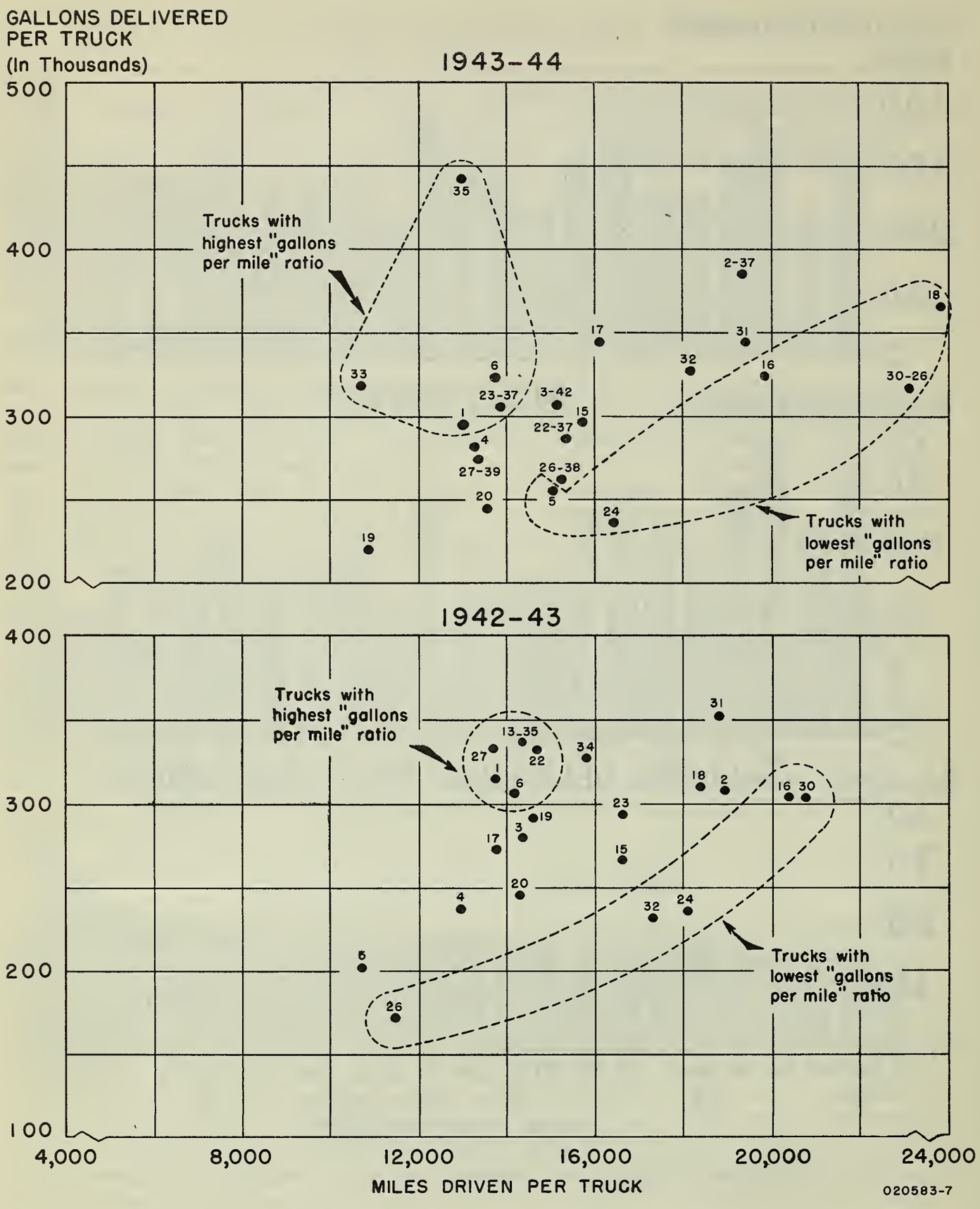


Figure 7. - Relation of gallons delivered per truck to miles driven per truck for fiscal years ended June 20-30, 1943 and 1944.
Note: (Truck code numbers appear beside dots. The 5 trucks with highest and lowest "gallons delivered per mile" ratio are enclosed by dotted lines.)

"gallons delivered per mile" go up 25 percent. If mileage is reduced 25 percent and volume remains constant, an improvement in delivery efficiency of 33 percent results. Furthermore, if one-fourth more volume is delivered on one-fourth less mileage, "gallons delivered per mile" increase 66.6 percent.

The 16 full-time trucks in 1941-42 delivered 16.5 gallons of fuel per mile driven, while the 22 trucks in 1942-43 averaged 18.2 gallons per mile, or a 10.3 percent increase (see table 3). This was effected mostly by a reduction in mileage of 17.8 percent as volume delivered declined 9.4 percent. (Fuel delivered to service agencies and stores constituted about 8 percent of the total in 1942-43). In 1943-44, the 22 trucks averaged 19.4 gallons per mile of travel, an increase of 6.6 percent over the previous year. This improvement was due to an 8.2 percent increase in volume, as mileage per truck remained almost the same. Thus, delivery efficiency was improved 17.5 percent from 1941-42 to 1943-44 in terms of gallons delivered per mile driven.

There were seven trucks in 1942-43 which showed an increase in gallons delivered per mile ranging from 1 to 15 percent over 1941-42; seven more showed increases above 15 percent (the highest was 35.1 percent); and only two showed declines - one was 1.1 percent and the other 18.6 percent. During 1943-44, eight trucks showed improvements ranging from 1 to 15 percent over 1942-43; seven had increases above 15 percent (the highest was 45.1 percent); and seven showed reductions ranging from 1.3 to 16.9 percent.

A frequency distribution of the "gallons delivered per mile" by trucks during the 3 years is shown in table 5. The range in 1943-44 was from 13.7 to 29.8 gallons per mile, exclusive of the truck handling fuel oil which delivered 34.1 gallons per mile. The high five trucks delivered more than 22.0 gallons per mile, while the low five delivered less than 17.5 gallons per mile of travel.

Table 5 - Frequency distribution of gallons delivered per mile driven by tank trucks for fiscal years ending June 20-30, 1942-44

Gallons delivered per mile driven	Number of tank trucks delivering specified gallonages per mile driven		
	1941-42	1942-43	1943-44
Less than 14.0 gallons	3	2	1
14.0 to 15.9 gallons	3	3	2
16.0 to 17.9 gallons	5	5	5
18.0 to 19.9 gallons	4	5	4
20.0 to 21.9 gallons	0	3	5
22.0 to 23.9 gallons	1	3	3
24.0 and over gallons	0	1	2
Total	16	22	22

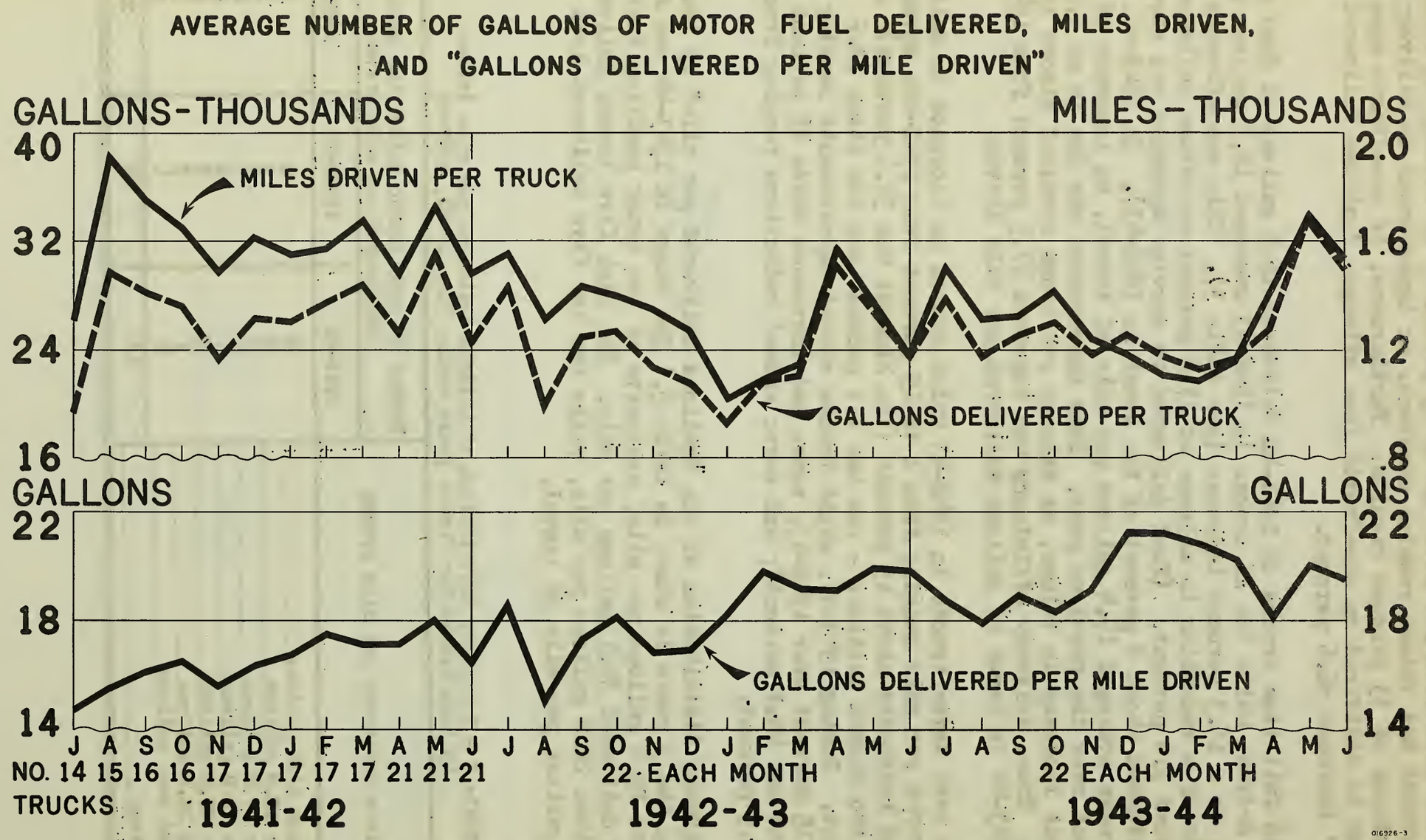


Figure 8. - Monthly delivery operations of tank trucks, 1941-42 to 1943-44: Average number of gallons of motor fuel delivered, miles driven, and "gallons delivered per mile driven."

Figure 6 shows the annual delivery operations of tank trucks for 1943-44 with the trucks arrayed from low to high on the basis of "gallons delivered per mile driven." Lower mileages and slightly higher volumes were responsible for the most efficient truck operations. However, trucks Nos. 19 and 20 indicate that it is possible to show a good gallonage per mile on a relatively low volume. Figure 7 further shows the relationship between volumes delivered and mileages driven by the trucks. Although more miles must be traveled in delivering the largest volumes, the five most efficient trucks had both a relatively high volume and a low mileage; while the least efficient trucks had relatively high mileages for the volume handled.

Figure 8 showing the monthly delivery operations of tank trucks for the 3 fiscal years indicates that a reduction in mileage was mainly responsible for the upward trend in efficiency and also that the highest efficiency tended to occur during months of highest volume. Each year the highest gallonage delivered per mile of travel was from February to June, inclusive. Since January 1943, however, a marked improvement has occurred as the average volume delivered per mile was above 18 gallons every month except one. Furthermore, in 1943-44, the best performance of the trucks occurred from December to March, inclusive. During this winter period, routes had been changed from a 2-week to a 4-week basis. Thus, it is evident that lengthening the interval of covering routes during the off-volume season improves delivery efficiency.

Data were not compiled on the total dollar volume of patrons' purchases per mile driven by each truck. However, in 1943-44 the dollar volume per association averaged $3.43 per mile driven by all trucks, with the range from $2.75 to $4.93 per mile. Other data on truck operations which is now being included or contemplated are the number of hours the truck is in use each day; the number of hours the farm serviceman works each day; the number of hours the truck is laid up for repairs; total number of calls; total number of deliveries; and average gallons per delivery.

In summarizing, a record of 19.4 gallons delivered per mile driven is an exceedingly good average for tank trucks operating in this area.6/ As mentioned, motor fuel consumption on farms is not as large here as in other sections of the United States; much of the terrain is rough; and

6/ During 1943, a group of 31 tank trucks of petroleum cooperatives in Wisconsin, Minnesota, and the Dakotas, most of which made deliveries on "orders," averaged 13.5 gallons per mile driven, with the range from 6 to 21 gallons per mile. (See Farm Credit Administration Misc. Report No. 77, "Delivery Conservation Practices of Cooperative Oil Associations Affiliated With the Farmers Union Central Exchange." Also, in 1942 2 of the highest volume cooperative trucks in Ohio making deliveries on routes delivered 20 gallons per mile. Reports for 1943 on cooperative trucks in Illinois, most of which operated on routes, indicated that they averaged 16 gallons per mile driven.

main road systems generally follow valleys with relatively few cross-roads connecting them. Performance records available in other areas show that relatively few trucks are delivering 20 gallons per mile of travel over a 1-year period. For the area included in this study, trucks should deliver at least 18 gallons per mile as two-thirds were exceeding this quantity; and 22 to 24 gallons per mile appears to be a good standard at which to aim.

Factors Causing Variations in Delivery Efficiency

The most significant improvements in delivery efficiency occurred in 1942-43 in those associations where a second or third truck was put into operation. The volumes of those trucks already in use usually declined when compared with 1941-42, but mileage was reduced to a much greater extent. A few, however, delivered a slightly larger volume on a reduced mileage. Then in 1943-44, their volumes generally improved with little additional mileage, thereby resulting in further improvement. As an illustration, a second truck was added late in 1942 at Dover. The first truck, No. 15, delivered 29 percent less fuel on 40 percent less mileage in 1942-43, thus increasing gallons delivered per mile 18.5 percent. In 1943-44, a further improvement of 17.5 percent was made by delivering 11 percent more fuel on 5.5 percent less mileage.

Comments regarding the reasons for variations among truck operations within each association are as follows:

Dover, Delaware - Truck No. 30 which operated south of the bulk plant, delivered only 13.7 gallons per mile in 1943-44 compared with 18.8 gallons for truck No. 15 which operated north of the plant, because it covered a much larger, undeveloped territory (see figure 1); it operated in a territory with 1.1 tractors per square mile compared with about 1.6 tractors in the other territory; and it had a change in farm servicemen during the period. Furthermore, it did not deliver to any service agencies while No. 15 served one.

Bel Air, Maryland - Truck No. 31, which operated east and south of the bulk plant, had less efficient deliveries, particularly in 1943-44 when it averaged 17.8 gallons per mile compared with 20.2 gallons for truck No. 3 which operated north and west of the plant. This was due to its longer hauls across the Susquehanna River and to the fact that it was used for delivering kerosene which required greater mileage in proportion to volume. Parts of its territory had slightly less tractors per square mile. Each truck served three service agencies.

Cockeysville, Maryland - It is difficult to make comparisons between years for trucks operated by this association, as their territories were revised several times and trucks were switched among the territories during the 3-year period. Also, there were a number of changes in farm servicemen. During 1943-44, truck No. 23-37 operated mostly southwest of the bulk plant and delivered 22.0 gallons per mile. In addition to gasoline and kerosene, this truck handled all of the 81,417 gallons of fuel oil distributed by the association in 1943-44. Truck No. 19 delivered north of the plant, and averaged 20.2 gallons per mile. Truck

No. 26-38 operated mostly southeast of the plant in an area which required more driving, hence it showed only 17.0 gallons per mile. None of the trucks delivered to service agencies.

Westminster, Maryland - Truck No. 4 operated northwest of the plant and delivered 21.3 gallons per mile in 1943-44. Truck No. 17 operated southwest of the plant and delivered 21.4 gallons per mile. Truck No. 22-37 served the full length of a long rectangular area east of the plant and delivered only 18.7 gallons per mile, although in 1942-43 it delivered 22.5 gallons. Thus, the performances of all three trucks normally have been much the same. It was estimated that No. 22 delivered 40 percent of the farm volume in its territory compared with 50 percent for No. 17 and 60 percent for No. 4. Each delivered to service agencies and stores.

Frederick, Maryland - Truck No. 16, which operated northeast of the bulk plant, delivered 14.9 gallons per mile in 1942-43 and 16.3 gallons in 1943-44. Truck No. 32, which operated west and south of the plant, delivered 13.4 gallons per mile in 1942-43 and 17.9 gallons in 1943-44. This appears to be a good record, as its territory was considerably larger than that of No. 16. Each delivered to service agencies and stores. Furthermore, the performance records of both trucks, while below average, are good considering the fact that another farmers' cooperative oil association at Frederick serves the same area.

Gaithersburg, Maryland - Truck No. 1, which operates west of the bulk plant, averaged almost 23.0 gallons per mile of travel each year. Truck No. 2, which operated east of the plant, delivered 19.9 gallons per mile in 1943-44. Truck No. 1 averaged somewhat above No. 2 in efficiency because its territory was located nearer the plant and because it supplied considerable fuel to a private service agency in the west end of the county.

Martinsburg, West Virginia - Truck No. 6 delivered the highest volume of any truck during the 3 years - 456,514 gallons in 1941-42. A second truck was added the latter part of that year so the volume of No. 6 was reduced about one-third the following year, but its mileage decreased slightly more. Truck No. 6, which operates west of the bulk plant, has the largest territory. It has to cross a mountain to serve one route, yet it delivered 23.5 gallons per mile in 1943-44. Truck No. 33-34, operating east of the plant, reached 29.8 gallons per mile this year by better planning of routes and filling in routes with new patrons. Both delivered to resellers.

Fairfax, Virginia - Truck No. 5 had the lowest gallonage delivered per mile (17.0 in 1943-44) mainly because it operated in a considerably larger territory south of the bulk plant. Truck No. 27-39 operated north of the plant in a smaller territory having larger users and averaged 20.7 gallons in 1943-44. Both trucks delivered to service agencies and stores. Truck No. 13-35 delivered fuel oil over the entire territory, much of which went to urban and city homes; thus, it delivered 34.1 gallons per mile in 1943-44.

Fredericksburg, Virginia - Truck No. 18 was the only one in operation during the entire 3-year period. Its gallonage delivered per mile, 15.3 to 16.8, is below average because of the one truck serving such a large territory and because of less tractor farming in this area.

Staunton, Virginia - Truck No. 20, which operated north of the bulk plant, delivered 18.2 gallons per mile in 1943-44. It exceeded No. 24 which delivered only 14.3 gallons because No. 20 had a smaller territory; it operated on a 3-weeks basis during the winter; it handled an estimated 50 percent of the farm business in its territory compared to 30 percent for No. 24; and it delivered about twice as much fuel to service agencies. No. 24 also had one route across a mountain a long distance from the bulk plant. In 1941-42 when the territories served by the two trucks were reversed, No. 24 delivered 16.1 gallons per mile compared to 14.8 gallons for No. 20. Approximately one-half of the volume of this association was delivered by the two trucks to the local service station of the Augusta Farm Bureau Cooperative Association at Staunton, Virginia. Thus, the gallons delivered per mile by them is perhaps higher than if most of the volume had been delivered to farms. Patrons of this cooperative were smaller users of fuel than those of the other nine associations.

In summarizing, practically all trucks, during the 3-year period under review, had the same size tanks and unloading pumps; about the same proportion of farmers had storage equipment of similar capacities; all trucks were operating on regular routes; practically all trucks were handling the same type of fuels; and all were operating under a rather uniform system. Therefore, variations in annual operations and efficiency of trucks and farm servicemen were due to such factors as the size and shape of territories in relation to the location of the bulk plant; the proportion of farm volume handled in the territory; density of patrons; the extent to which routes were well organized and currently revised; changes in farm servicemen and their abilities; the topography and road system in each territory; and the extent of power farming in the area.

Truck Operating Expenses Per Gallon and Per Mile

The most important measures of the efficiency of the operation of a farm serviceman and his truck are the delivery costs per gallon of fuel handled and the costs per mile driven. Delivery costs consist of two main types, namely, the operating expenses of the truck and the compensation of the farm serviceman.

The following data apply only to those trucks which were in operation at least 10 months of each year. Some of these trucks were used in more than one territory and in more than one association during the year. Therefore, data on volume delivered and mileage driven by them will vary from that shown in previous tables where such data were compiled on the truck or trucks serving a certain territory of an association during the year.

Table 6 shows that the average annual operating expenses per truck by years were as follows: $1,530 in 1941-42; $1,360 in 1942-43; and $1,450 in 1943-44. It is noted that gasoline expense declined during the period as a result of the reduction in travel; tires and tubes and repairs increased; and interest, taxes, depreciation, and insurance decreased.

Table 6 - Average annual operating expenses per tank truck in 10 petroleum cooperatives for fiscal years ended June 20-30, 1942-44 a/

Expense item	1941-42	1942-43	1943-44
		Dollars	
Gasoline	357.08	328.80	315.53
Oil, grease, anti-freeze	36.40	29.79	28.18
Tires and tubes	178.57	165.99	225.58
Repairs	263.49	238.80	339.67
Interest, taxes, insurance, and depreciation	694.75	599.28	541.42
Delivery service adjustment b/	-	- 2.26	- .54
Total	1,530.29	1,360.40	1,449.84

a/ See footnote of following table for data on number of trucks included and their average annual volumes delivered and mileages driven.

b/ See text for explanation of this item.

Table 7 - Average annual truck operating expenses per gallon delivered and per mile driven by tank trucks of 10 petroleum cooperatives, for fiscal years ended June 20-30, 1942-44 a/

Expense item	Expenses per gallon			Expenses per mile		
	1941-42	1942-43	1943-44	1941-42	1942-43	1943-44
			Cents			
Gasoline	0.11	0.12	0.11	1.9	2.1	2.1
Oil, grease, anti-freeze	.01	.01	.01	.2	.2	.2
Tires and tubes	.06	.06	.08	.9	1.0	1.5
Repairs	.08	.08	.12	1.4	1.5	2.3
Interest, taxes, insurance, and depreciation	.22	.21	.18	3.6	3.8	3.7
Total b/	.48	.48	.50	8.0	8.6	9.8

a/ Includes only the following number of trucks which were in operation at least 10 months of each designated year: 1941-42, 16; 1942-43, 21; and 1943-44, 22. Average gallonage delivered per truck: 1941-42, 314,479; 1942-43, 282,457; and 1943-44, 291,097. Average mileage driven per truck: 1941-42, 19,082; 1942-43, 15,739; and 1943-44, 14,864.

b/ "Delivery service" adjustment was negligible when computed on the basis of amount per gallon and per mile.

Table 8 - Frequency distribution of truck operating expenses per gallon and per mile for fiscal years ended June 20-30, 1942-44

Total operating expenses	Number of trucks having specified expenses		
	1941-42	1942-43	1943-44
Per gallon:			
0.30 - 0.39 cent	1	2	2
0.40 - 0.49 cent	10	10	8
0.50 - 0.59 cent	3	6	10
0.60 - 0.69 cent	2	3	2
Total	16	21	22
Per mile:			
7.0 - 7.9 cents	8	2	0
8.0 - 8.9 cents	8	13	3
9.0 - 9.9 cents	0	5	9
10.0 - 10.9 cents	0	1	8
11.0 - 11.9 cents	0	0	2
Total	16	21	22

As indicated by table 7, total truck operating expenses were equal to about one-half cent per gallon - to be exact, 0.48 cent per gallon the first 2 years and 0.50 cent in 1943-44. When computed on a mileage basis, however, they increased from 8.0 cents in 1941-42 to 9.8 cents in 1943-44, or approximately 24 percent. However, a truck with a high volume and a low mileage would be likely to show a higher cost per mile than one with a high mileage. These costs appear to be very reasonable considering the type of territory and roads over which the trucks must travel and considering the age and condition of many of the trucks.

It is noted that on a per-gallon or a per-mile basis, most of the expenses such as gasoline, depreciation, and insurance remained fairly constant, but expenditures for tires, tubes, and repairs accounted for the increase. The number of trucks each year with specified operating expenses per gallon and per mile is shown in table 8.

Basis of Computing Expenses

To make comparisons between operating expenses of trucks, it is not only necessary to know items included but also the basis upon which they are computed. The various expenses of the trucks in this study were figured by the cooperatives in their operating statements on the following basis: Gasoline, oil, grease, and anti-freeze were charged to the trucks at the cost price to the local cooperatives. A reserve for tires and tubes was charged to expenses each month at the rate of 1-1/2 cents per mile. In cases where deficit balances occurred, a rate of 2 cents per mile was used. Actual expenditures are charged against the reserve at cost prices to the cooperatives.

A "reserve for repairs" was charged to expenses monthly at the rate of 2 cents per mile until February 1943. Since that time, a rate of $30 per month has been used, of which $10 was for parts and $20 was for services of the traveling maintenance men. Operating supplies, such as

spark plugs and oil filter elements, are included in repairs. Such a plan distributes evenly over the 12 months' period the truck repair expense of cooperatives and the income to the Petroleum Management Service for the traveling maintenance men.

In the past, depreciation on both the truck and the tank has been figured on the basis of a life of 125,000 miles. Beginning November 1, 1944, a policy was established for depreciating them separately. The rate for the trucks is based on full depreciation at 80,000 miles. Their cost value and expected mileage were determined as of October 30, 1944, and the depreciation rate per mile was computed from these data. The tanks are to be depreciated on a straight-line basis over a 10-year period. Their cost, expected life, and annual depreciation rate were computed as of October 30, 1944.

Taxes included only State registration fees for license plates, city tags, and Federal use stamps. Personal property taxes on the trucks were not included because of variations in amounts and methods of assessing them in different States. Social security taxes on the farm servicemen and the costs of bonding farm servicemen were not included. Insurance included public liability and property damage, collision, fire, and theft provisions. Interest expense was computed at 5 percent per annum on the original cost of the truck and tank. The average amount of interest expense in 1943-44 was approximately $136 per truck.

The item of "delivery service" was included in operating statements to handle the loaning of a truck from one association to another. For the association borrowing a truck, "delivery service" is shown as a charge to truck expense and also as a separate charge to plant operating expenses. For the plant owning the truck, only a credit to truck expense is shown under the item "delivery service" for the amount of the rental cost involved.7/

When operating statement forms for truck expenses are revised, it is recommended that only direct expenses be included and that they be itemized as follows: gasoline, motor oil, lubrication and anti-freeze, tires and

7/ For example, association B has a truck laid up for repairs, so it borrows a spare truck (No. 49) from association A for 5 days at the usual rental rate of $5 per day. Association B would show rental cost of $30 as "delivery service" expense in its statement entitled "Comparative Analysis of Operating Expenses." (See Appendix.) Also, it would show the cost of the gasoline, oil, grease, and other expenses plus the "delivery service" expense for truck No. 49 in the "Statement of Truck Performance" (see Appendix) to show the total cost of the borrowed truck for that period. Association A would show in its "Statement of Truck Performance" the depreciation, taxes, insurance, and similar costs for its spare truck No. 49, and then a credit of $30 would be entered under the item of "delivery service," thereby reducing by this amount the cost of the spare truck to the association. The "delivery service" credit would not be shown in the "Comparative Analysis of Operating Expenses" for this plant.

tubes, chains and small tools, repairs and operating supplies, insurance, licenses and taxes, depreciation, delivery service, miscellaneous, and total truck operating expense. Interest was not included as it is believed to belong with other general overhead and operating expenses of the association. However, if interest is included, then it is suggested that a subtotal be shown before interest because the amount may vary greatly among associations. Wages of the farm servicemen should be shown next and on the following line the combined social security and unemployment taxes, workmen's compensation payments, and bonding expense of the farm serviceman. The subtotal for these two lines would be "farm serviceman's costs." Then the last line would show "total delivery costs." Perhaps this procedure may now be in use under the truck preventive maintenance program recently adopted.

Mileage Per Gallon of Gasoline Used

The trucks in this study averaged 8.0 miles per gallon of gasoline used in 1942; 7.4 miles in 1943; and 7.4 miles in 1944. During the latter year an average of 2,018 gallons of gasoline was used per truck in driving 14,864 miles. Some of the mileages driven in 1943-44 had to be estimated because it was impossible to get speedometer repairs. A distribution of the mileages realized by trucks during the 3-year period is shown in table 9. There was little variation in the performance of trucks on the basis of their make. Age, condition, and care in operating the trucks were the principal factors causing variations and declines in mileage per gallon.

Table 9 - Frequency distribution of "mileages per gallon of gasoline used" by tank trucks of 10 petroleum cooperatives for fiscal years ended June 20-30, 1942-44

Mileages per gallon of gasoline	Number of tank trucks realizing specified mileages		
	1941-42	1942-43	1943-44
Less than 6.0 miles	0	1	2
6.0 - 6.9 miles	2	7	5
7.0 - 7.9 miles	3	7	5
8.0 - 8.9 miles	9	4	9
9.0 and over miles	2	2	1
Total	16	21	22

Farm Servicemen's Wages Per Gallon and Per Mile

All farm servicemen of the association were employed on a salary basis. None received bonuses nor commissions on net savings or volume. Most were paid in 1944 on a weekly basis ranging from $24.50 to $37.50 per week, which was equivalent to $1,430 to $1,850 per year. The average was estimated to be approximately $27.50 per week, or $1,430 per year in 1942; $30 per week, or $1,560 per year in 1943; and $32.50 per week, or $1,690 per year in 1944.

In the preparation of the "truck performance" section in the operating statements, the policy has been to allocate part of the wages of farm

servicemen to delivery costs and part to general operating expenses of the association. The reasoning was that farm servicemen devote part of their time to membership and educational work while on their trucks and also part of their time to general duties while at the plant.8/ Such costs were allocated on the basis of average wages of farm servicemen which were estimated as $3.33 per day until June 30, 1943, and $5.00 per day since that time. The variations in wages per truck were due to differences in days the trucks were in operation.

The amount of wages allocated to delivery expense averaged $907 per farm serviceman in 1941-42; $866 in 1942-43; and $1,251 in 1943-44. These amounts represented about three-fourths of the actual amounts paid in 1943-44. No social security taxes or bonding expenses were included in the costs of farm servicemen.

Table 10 shows farm servicemen's wages per gallon delivered and per mile driven based upon amounts allocated to delivery costs in operating statements, and also based upon the estimated total wages received by them. Such costs greatly increased from 1941-42 to 1943-44. The wages, as allocated, averaged slightly more than 0.4 cent per gallon and 8.4 cents per mile in 1943-44, while estimated total wages paid averaged 0.58 cent per gallon and 11.4 cents per mile. In 1943-44 an assumed salary of $1,800 per year per man would have equalled 0.62 cent per gallon and 12.1 cents per mile. Each $300 change in salaries caused a change of 0.10 cent per gallon and 1.9 to 2.0 cents per mile (see table 11).

Total Delivery Costs Per Gallon and Per Mile

Total delivery costs consist of the truck operating expenses and the farm servicemen's wages. On the basis of the associations' operating statements, where a part of the farm servicemen's wages was allocated to general expenses, total delivery costs averaged 0.76 cent per gallon in 1941-42; 0.79 cent in 1942-43; and 0.93 cent in 1943-44. They averaged 12.6, 14.1, and 18.2 cents per mile driven for these 3 years respectively, (see table 10). When total estimated wages of farm servicemen were included, total delivery costs averaged 0.92 cent per gallon in 1941-42; 1.03 cents in 1942-43; and 1.08 cents per gallon in 1943-44. Delivery costs per mile for the 3 years averaged 15.3, 18.5, and 21.2 cents, respectively.

On the basis of an arbitrary salary of $1,500 per year for all farm servicemen and the same gallonages delivered and mileages driven, total delivery costs would average slightly over 1 cent per gallon and from 18 to 20 cents per mile the last 2 years (see table 11).

8/ Most petroleum cooperatives throughout the country include the total salaries of the farm servicemen in computing delivery costs. Some associations having several departments allocate a portion (as 2 percent) of the general overhead expense to delivery costs in addition to the entire salary of the farm serviceman. Thus, the basis of computation is important in comparing delivery efficiency and costs among cooperatives.

Table 10 - Total delivery costs per gallon and per mile of tank trucks of 10 petroleum cooperatives for fiscal years ended June 20-30, 1942-44 a/

Cost item	Cost per gallon			Cost per mile		
	1941-42	1942-43	1943-44	1941-42	1942-43	1943-44
	Cents					
Farm servicemen's wages as allocated to delivery costs b/	0.28	0.31	0.43	4.6	5.5	8.4
Truck operating expenses	.48	.48	.50	8.0	8.6	9.8
Total delivery costs	.76	.79	.93	12.6	14.1	18.2
Farm servicemen's wages - Estimated total b/	0.44	0.55	0.58	7.3	9.9	11.4
Truck operating expenses	.48	.48	.50	8.0	8.6	9.8
Total delivery costs	.92	1.03	1.08	15.3	18.5	21.2

a/ Includes only the following number of trucks which were in operation at least 10 months of each designated year: 1942 = 16; 1943 = 21; and 1944 = 22. See footnote 1 of table 7 for average gallonages and mileages of trucks by years.

b/ See text for average wages per farm serviceman as allocated to delivery costs and for the estimated total wages paid.

Table 11 - Influence of farm servicemen's wages on total delivery costs per gallon and per mile, as shown by using assumed annual wages for all farm servicemen (other costs remaining constant) for fiscal years ended June 20-30, 1942-44

Cost item	Cost per gallon			Cost per mile		
	1941-42	1942-43	1943-44	1941-42	1942-43	1943-44
	Cents					
Farm servicemen's wages at $1,500 per annum for each man	0.48	0.53	0.52	7.9	9.5	10.1
Truck operating expenses	.48	.48	.50	8.0	8.6	9.8
Total delivery costs	.96	1.01	1.02	15.9	18.1	19.9
Farm servicemen's wages at $1,800 per annum for each man	0.57	0.64	0.62	9.4	11.4	12.1
Truck operating expenses	.48	.48	.50	8.0	8.6	9.8
Total delivery costs	1.05	1.12	1.12	17.4	20.0	21.9
Farm servicemen's wages at $2,100 per annum for each man	0.67	0.74	0.72	11.0	13.3	14.1
Truck operating expenses	.48	.48	.50	8.0	8.6	9.8
Total delivery costs	1.15	1.22	1.22	19.0	21.9	23.9
Farm servicemen's wages at $2,400 per annum for each man	0.76	0.85	0.82	12.6	15.2	16.1
Truck operating expenses	.48	.48	.50	8.0	8.6	9.8
Total delivery costs	1.24	1.33	1.32	20.6	23.8	25.9

Using $1,800 per year, total costs would be slightly over 1.1 cents per gallon and from 20 to 22 cents per mile the last 2 years. The range in delivery costs (using $1,800 salaries for all farm servicemen) would have been from 0.71 to 1.47 cents per gallon and from 16.3 to 29.1 cents

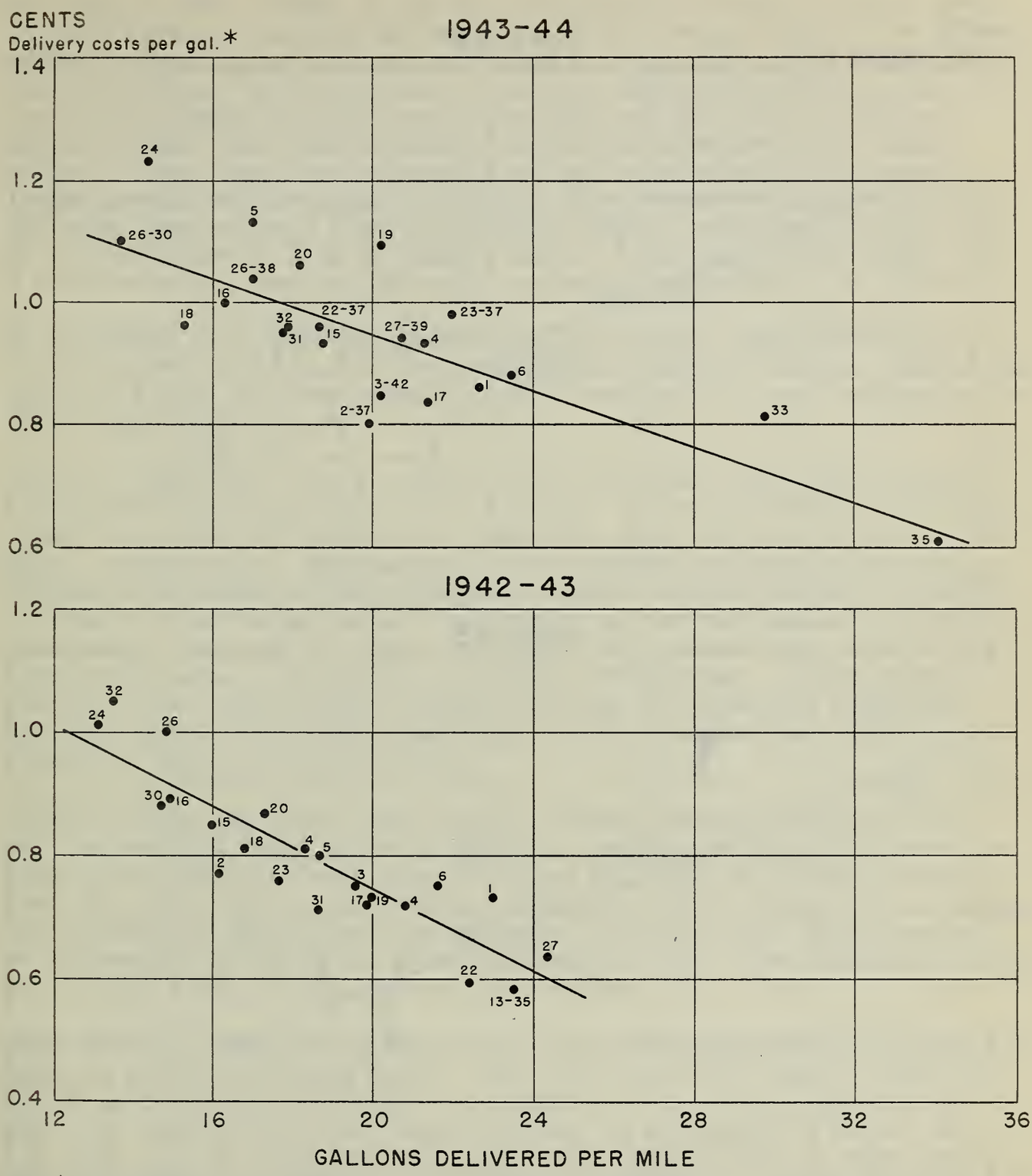
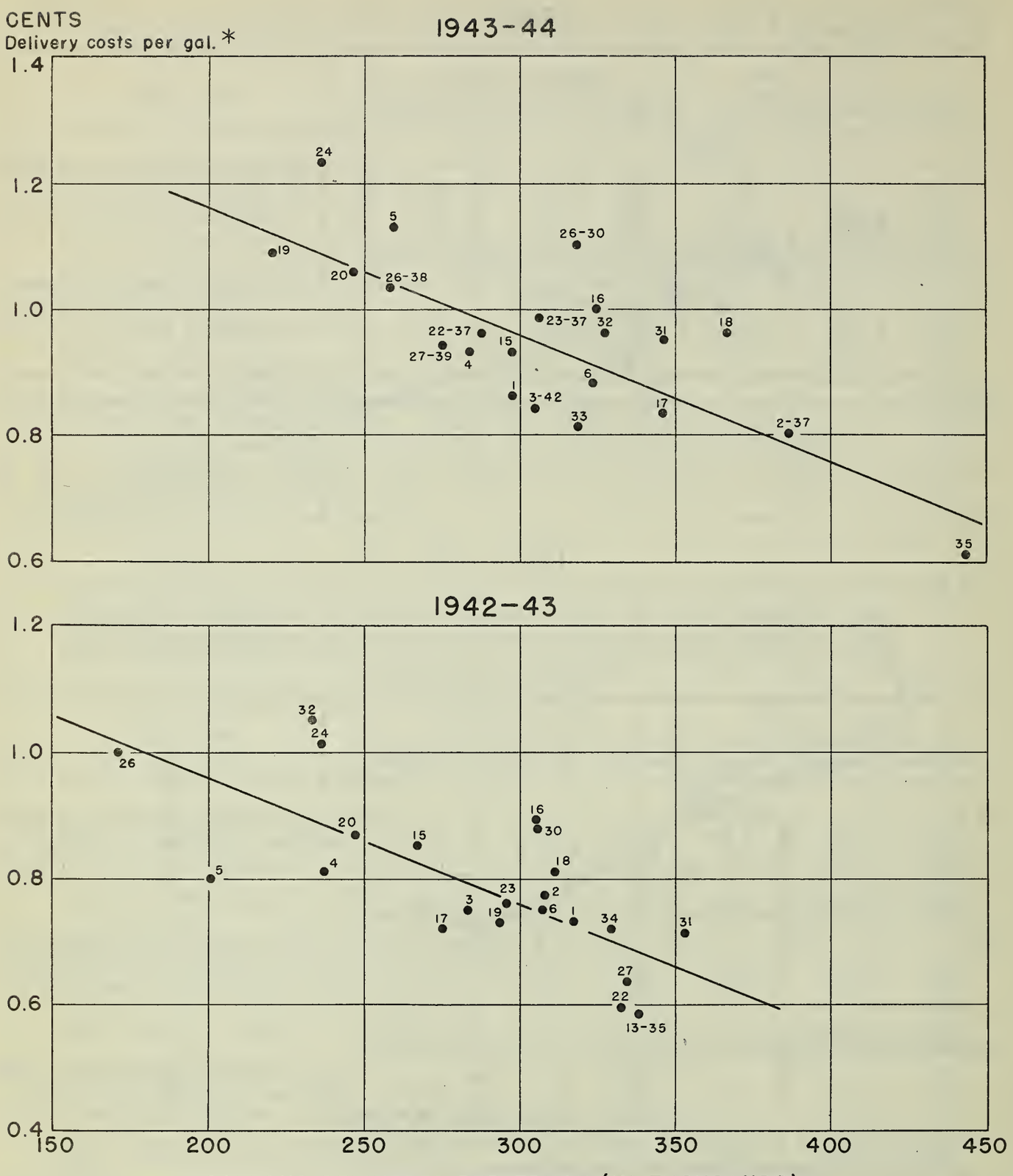


Figure 9. - Relation of gallons delivered per mile to delivery costs per gallon by tank trucks for fiscal years ended June 20-30, 1943 and 1944.



*INCLUDES ONLY AN ALLOCATED PORTION OF FARM SERVICEMEN'S WAGES

NOTE: FIGURES REPRESENT TRUCK CODE NUMBERS

016926-4

Figure 10. - Relation of gallons delivered per truck to delivery costs per gallon during fiscal years ended June 20-30, 1943 and 1944.

per mile in 1944. Three of the 22 trucks would have had delivery costs of less than 1.0 cent per gallon; 6 would have ranged from 1.0 to 1.09 cents; 6 from 1.1 to 1.19 cents; 3 from 1.2 and 1.29; and 4 would have had costs of 1.3 cents or more per gallon. Frequently those trucks having the highest delivery costs per mile had the lowest costs per gallon because they kept mileage to a minimum in delivering a large volume. Thus, total costs per mile are of value mainly for comparing trucks having similar annual mileages. Five trucks would have had delivery costs of less than 20 cents per mile; 6 would have ranged from 20 to 21.9 cents; 4 from 22 to 23.9 cents; 2 from 24 to 25.9 cents; and 5 would have had costs of 26 cents or more per mile driven in 1943-44.

On the basis of an assumed salary of $2,100 for all farm servicemen, total delivery costs would have averaged 1.2 cents per gallon, and on the basis of $2,400 per year they would have averaged 1.3 cents per gallon in 1942-43 and 1943-44.

Delivery costs of 1 cent per gallon would represent about 47.6 percent of the total handling cost of 2.1 cents per gallon in 1943-44. Delivery costs of 1.1 and 1.2 cents would constitute 52.4 and 57.1 percent of the total, respectively. Furthermore, using average percentages of types, volumes, and prices of fuels handled in 1944, delivery costs of 1 cent per gallon would be equivalent to about 6 percent per dollar of patrons' purchases. Costs of 1.1 cents would equal 6.7 percent and costs of 1.2 cents would equal 7.25 percent per dollar of business. (Only about 4 percent of the total dollar volume consisted of automotive supplies). Delivery costs in many petroleum cooperatives elsewhere are equal to 10 percent of sales or dollar volume.

Figure 9 shows the close relationship between "gallons delivered per mile driven" and total delivery costs of trucks, and figure 10 shows the close relationship between annual volumes delivered and total delivery costs for each truck in 1942-43 and 1943-44. In the latter year, trucks with volumes of 250,000 gallons had total delivery costs (as allocated on statements) of about 1.1 cents per gallon, while those handling 325,000 gallons had costs of only 0.9 cent per gallon.

These data show that motor fuels were being moved from bulk stations to farms on a very efficient basis. Even when a delivery cost of from 1.0 to 1.2 cents per gallon among these cooperatives is used, this is somewhat less than the delivery costs (figured on a comparable basis) of 1.3, 1.5, or 1.75 cents per gallon for many associations in other parts of the country. Certainly they are much less than the usual amounts paid on a commission basis to truck operators by most cooperatives.

The average annual volume delivered per farm serviceman of over 300,000 gallons was very good and the 19.4 gallons delivered per mile of truck travel was exceedingly high considering the area served. As pointed out later, the operation of routes and the placing of proper storage equipment on farms were responsible for much of this efficiency.

However, there appear to be possibilities for further improvement in delivery efficiency - especially by obtaining more patrons in a given

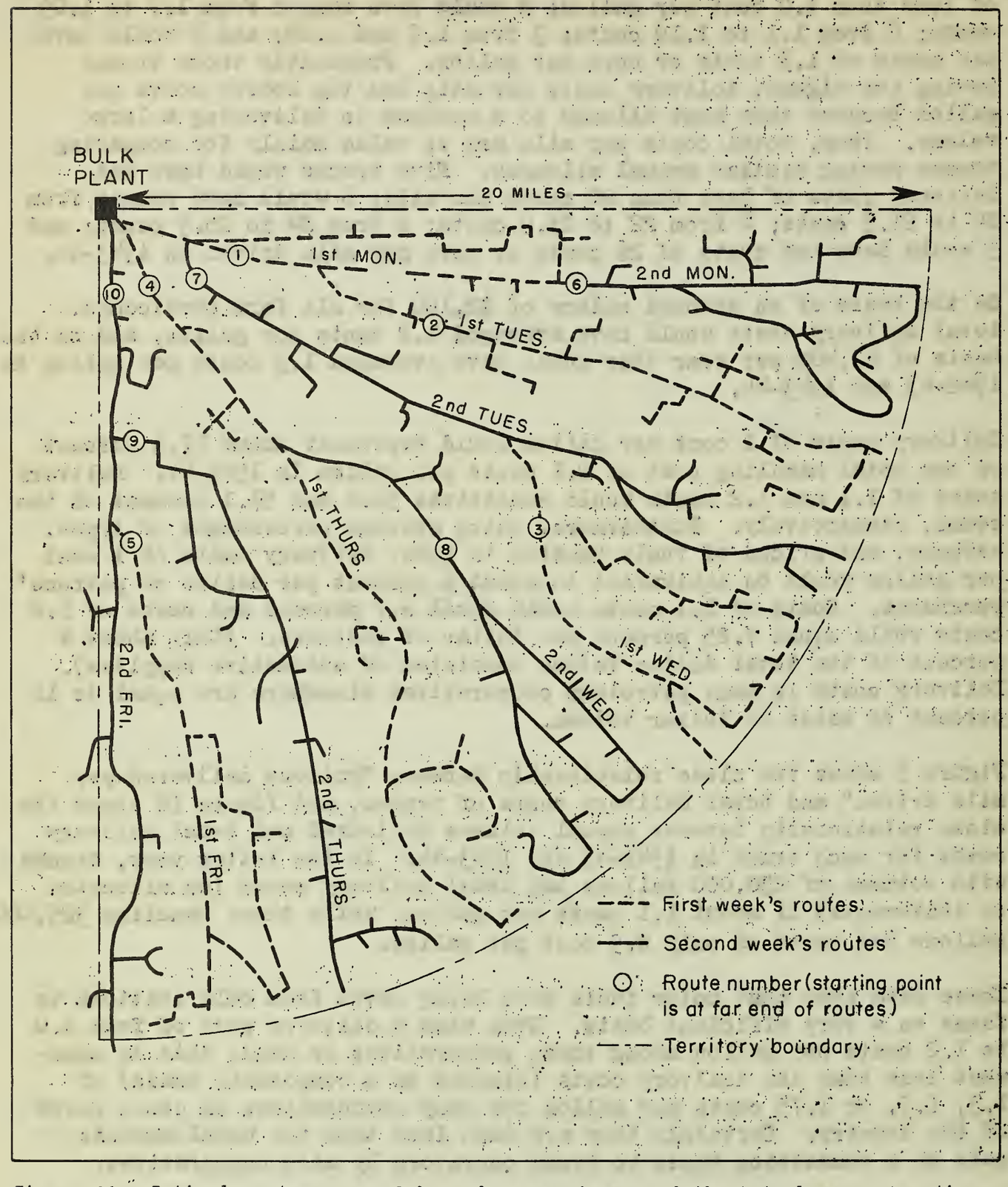


Figure 11. - Typical routes covered by a farm serviceman of the petroleum cooperatives.

area and also more volume from present patrons. As discussed later, the use of larger truck tanks in level areas; the preventive maintenance program for trucks; the use of trailers from which trucks would refill in serving the longest routes; possibly the use of branch or sub-bulk plants in areas of heaviest consumption; improvement of farm lanes; and shorter and more stable routes should aid in improving delivery efficiency. Thus, it is evident that maximum efficiency will not be attained until associations reach maturity; until maximum volume has been obtained; and until there is a minimum turnover of patrons.

ORGANIZING AN EFFICIENT ROUTE SYSTEM

Practically the entire volume of petroleum products handled through the 10 petroleum cooperatives included in this study is delivered to farms by tank trucks. To attain efficient operation, deliveries are scheduled on well-organized daily routes which are consistently followed. Each farm serviceman has 10 to 12 regular routes which are normally covered over a 2-week period. The operation of the bulk plant is geared to these routes. On them farm servicemen obtain new patrons, build volume, control credit, and handle membership relations.

Route Maps and Farm Servicemen's Truck Books

Route Maps and Sheets

The guide and check for route operations is a map on which are shown the daily routes of the different farm servicemen of a cooperative. Figure 11 shows typical simplified routes of one farm serviceman. These maps are usually 3 or 4 feet square and are mounted in the office in a convenient location for use of employees. They contain the location of farms and the names of land owners, and they show roads, cities, and railroads.

Different colored gimp strings designate the various daily routes of each farm serviceman. Each string is strung around the heads of long, common pins. Key pins with numbers on their heads designate the code numbers of the routes. Another set of short pins with heads of three different colors, indicate the location and status of patrons; that is, patrons with their own equipment, patrons with cooperative-owned equipment, and prospective patrons. The long pins mentioned above hold the route strings off the map, thus permitting the changing of short colored pins without disturbing the strings.

"Route sheets" are posted on each side of the map. A separate sheet contains a list of patrons on each route in the order in which they are served. On each sheet is fastened a piece of the same colored string that is used on the map for this particular route. Thus, in answering farmers' inquiries or special requests for fuel, employees can tell at a glance the day the farm serviceman is scheduled to be at a certain farm and the approximate location of the serviceman at any time.

These route maps and sheets, therefore, show not only the routes but also the numbers and names of patrons served, by days; the order in

which patrons on routes are served; the type of patrons' storage equipment; and the degree to which the trade area is covered. Managers and farm servicemen are responsible for keeping the route maps and sheets up-to-date.

Farm Servicemen's Truck Books

Along with the use of the route map and the sheets, each farm serviceman is required to keep a set of truck books containing individual records for each of his patrons. These records are grouped by routes and each truck book contains the routes covered in a week. There is a separate sheet for each patron. On it is posted the date of each purchase, the gallons and the amount of each kind of fuel purchased, the charges, the collections, and the balance due the cooperative (see form 1). These sheets for each patron are arranged in the book in the order in which patrons are served on the daily scheduled routes.

It has been the practice to leave the first week's book in the office for review by the manager while the second week's routes were being covered, and vice versa. However, farm servicemen frequently had need for both books so some associations are now keeping also a master ledger of the daily purchases of each patron arranged by routes on which they are served. Such records are kept by the bookkeeper; they can be reviewed by the manager at any time; and they serve as permanent patronage records.

Form 1 - Example of Form Used in the Farm Servicemen's Truck Books

Name_____
Address_____
Directions to farm_____
Route No._____

Date	Invoice	Gasoline	Kerosene	Oil	Tires	Grease	Miscellaneous	Cash purchases	Amount charged	Amount received on accounts	Balance due

In addition to the regular patrons' sheets, the book contains separate sheets for each prospective patron. These show the dates of calls made by the farm servicemen and brief remarks for future reference. It is important that farm servicemen keep truck books up-to-date at all times. When this is done, these books show at a glance a patron's performance as to both kinds and quantities of fuel purchased and frequency of purchases. Furthermore, they assist the farm servicemen in controlling credit and making collections while on their routes.

Organization and Operation of Routes

Each farm serviceman has a prescribed territory in which his routes are established (see figure 1). Territories usually range from 400 to 600 square miles. Routes are set up on a 2-week schedule, and those covered on the same days of the first and second weeks are - where possible - located in the same community or area. For instance, the recommended policy is to establish the second Monday's route parallel to the first Monday's route (see figure 11). However, where this is not feasible because of the road system and the location of patrons, the second Monday's route is set up beyond the first Monday's route on the same road. Thus the serving of parallel routes, on first and second Mondays, for example, facilitates the serving of necessary special calls from adjacent routes with little if any additional mileage. Patrons whose supply of fuel does not last 2 weeks know that on a certain day the truck will be in or near their locality and they can place orders accordingly. As one manager expressed it, the secret of their success in operating the route system is the arrangement whereby a truck has to go through or near the first week's routes to get to those on the corresponding days of the second week.

In one association the first week's routes run east of the bulk plant and the second week's, in the opposite direction. While this plan may encourage some farmers to take a full 2-weeks' supply of fuel and discourage special orders, its success is dependent upon storage capacity adequate for a 2-weeks' supply being available on each farm. Furthermore, such a system does not permit the handling of emergency calls on minimum time and mileage. In another association where the territories of two farm servicemen join, the first Monday's route of one is parallel to the second Monday's route of the other; therefore, either serviceman can serve patrons on the other's route who may be in need of fuel at the end of a week.

When a farm serviceman misses an entire day, he usually tries to handle 2 days' routes on the following day by working longer hours. If possible, some patrons put off until the following Saturday. Location of patrons, topography, and the road system in a locality cause wide variations in the patterns of individual routes. Some are along one road; others have many off-shoots; while some are of horseshoe shape.

While routes must be revised constantly as changes occur in farmers and cooperative patrons, they have been subject to several major revisions since the associations started because of their increasing membership and volume of business. The usual procedure in putting on a new truck

is to establish definite routes for it, which may involve division of existing routes and the setting up of new routes having few if any old patrons, and then to fill in patrons as rapidly as possible. While this is rather an inefficient procedure at the beginning, it has usually been found to be the quickest and most satisfactory way to build up routes.

Frequency of Covering Routes

The standard plan used by the associations provides for the covering of routes every 2 weeks. This seems to be the most satisfactory interval between deliveries - from the standpoints of both farm storage capacities and the quantities of fuel that farmers prefer to buy and pay for at one time. While there was wide variation in the size of purchases among patrons, those with drums would frequently take from 50 to 100 gallons at a time while those with 270-gallon tanks would purchase about 200 gallons. The average for all patrons was estimated to be approximately 100 gallons per delivery.

If farm servicemen are to stay on a 2-week route schedule consistently, it is necessary that each patron have sufficient storage to hold his peak requirements for that period. Since this is not always the case, farm servicemen endeavor to keep their operations sufficiently flexible to permit adjustments to seasonal conditions. During the seasons of heavy field work from three to four loads of fuel are required to supply a route compared with an average of two loads in the more normal periods.

Since the beginnong of the war, the farm servicemen have reduced the frequency of covering routes during the winter months when farm consumption of motor fuel is lowest. They have usually covered routes every 4 weeks during the months of December, January, and February. A few have tried 3-week schedules. During the winter of 1944, one organization with three trucks assigned one truck to devote every third week to serving only kerosene patrons. The manager of another association whose routes were operated on a 4-week basis that winter stated that he planned to put them on a 3-week schedule in the winter of 1945 so one of the trucks could be taken off duty each week for monthly servicing, check-up, and repair.

While lack of storage frequently caused a number of call-backs during the winter under a 3-week or 4-week route system, managers believed that lengthening the interval at which routes were covered during slack seasons resulted in considerable saving of mileage. Where storage capacity permitted, managers seemed to prefer the 4-week schedule over the 3-week one during the winter as it meant less revision of routes. However, it was mentioned that, in either case, if a patron did not pay for his current purchase his account had to be placed in the 30-days or longer classification. (This did not occur if a payment was missed when routes were covered every 2 weeks.) As shown in figure 8, gallons delivered per mile averaged much higher during the winter of 1943-44 when most trucks operated on 4-week routes. Consideration might even be given to establishment of regular routes on a 3-week rather than a 2-week basis, in new associations, or in present ones where relatively little change in farm-storage facilities would be required.

Method of Covering Routes

Associations stated that their farm servicemen always started delivering at the farthest point on the route. If they run out of fuel before completing the route, the remaining farms can be served then from the next load or part of a load on minimum mileage. One manager said that his farm servicemen always begin with the small farms having drums and complete deliveries on farms with large tanks if possible as an aid in disposing of their entire loads. Some routes are retraced in returning to the bulk plant, but frequently short cuts can be taken if all the fuel in the truck tank has been disposed of. Most associations reported that whenever an entire load of fuel was not disposed of on a certain day's route, the serviceman disposed of the remainder on the following day's route.

Number of Patrons on Routes

The number of patrons on a given route was generally larger than the number actually served each time it was covered. Small users or those purchasing kerosene mainly did not always purchase fuel every 2 weeks or each time the route was covered.

There was considerable variation in the number of patrons on a route depending on their requirements for fuels and their distance from the bulk plant. Data listed on route sheets accompanying maps showed that in 1944 there was an average of 18 patrons per route for 16 farm servicemen. This included the first 5 days of each week. The range was from 12 to 25 patrons per route. Some individual routes, however, had only 5 or 6 patrons while others had as many as 30. The total number of patrons on two 6-day weeks of routes averaged 191 per farm serviceman. The range was between 146 and 279. These data, however, have limitations in that some lists included only the regular patrons or the gasoline patrons rather than all patrons; and some lists were not up-to-date.

The average number of patrons actually served per week by each of 22 farm servicemen during the period from November 1, 1943, to September 16, 1944, was 55. This was equivalent to approximately 11 patrons per daily route. The range was from 47 to 68 per week. The average size of delivery per patron was 113 gallons, with the range from 87 to 143 gallons among the 22 farm servicemen. The number of patrons served was greater during the spring months of heavy fuel consumption, but the size of delivery per patron varied little by months.

In August 1944, farm servicemen were requested to start recording the number of "calls" made as well as the number of patrons served. During the period August 12 to September 16, inclusive, farm servicemen made an an average of 62 calls and served 51 patrons per week. The range was from 30 to 80 calls and from 29 to 63 patrons served per farm serviceman per week.

Several managers were of the opinion that a farm serviceman could usually serve from 18 to 20 patrons on most routes satisfactorily. On the basis of 5 daily routes per week, this would give each farm serviceman from

180 to 200 patrons to be served every 2 weeks. If approximately 2 loads - 1,600 gallons - of fuel were delivered per day, this would be an average of 8,000 gallons per week, or from 80 to 88 gallons per patron. However, when prospective patrons were contacted on regular routes, most managers believed that 15 stops on a route would be as many as should be made. This would enable farm servicemen to serve 10 to 12 patrons and to contact from 3 to 5 prospects. It was pointed out that it frequently takes an hour or more to discuss the cooperative, its products, and its services with prospective patrons.

Length of Routes

Routes varied greatly in length. Some were adjoining the bulk station, while others were in the far corners of the trade territory. Density of farms with power machinery, the proportion of farmers in a given area who were members and patrons of the cooperative, and fuel consumption of individual patrons, determined the length of routes. Also, the mileage traveled in covering a route varied by seasons. During seasons of intensive field work, from three to four loads of fuel per day were often delivered on a route, whereas one to two loads was the average during slack seasons.

During both 1942-43 and 1943-44 the average distance driven per route was 30 miles round trip, figured on the basis of the average mileage driven per day by 22 trucks, during a 5-day week, and an average of 2 trips from the bulk station per day in covering a route (see table 3). The longest route covered by any farm serviceman was 100 miles round trip, made necessary by the crossing of a mountain.

The reduction in size of farm servicemen's territories and in length of routes by means of installing branch or sub-bulk plants is discussed in a later section of this report. Limiting routes to perhaps 15 miles in length should greatly improve delivery efficiency, but the volume available in such an area and the added investment, costs, and disadvantages of operating branch plants would have to be considered.

Standing Orders and Dumping Stations

Managers reported that before the war a few of their patrons - perhaps 10 percent - had an understanding with farm servicemen to fill their drums or tanks on regular route days. These might be referred to as "standing orders" for fuel. After the war began, however, under the threat of general fuel shortages, a large proportion of the farmers placed such orders.

There were a few farmers with large tanks in the territory of each farm serviceman who agreed to let him dispose of any extra fuel remaining on his tank truck at the end of the route or the day. These patrons and the cooperative service agencies and stores with curb pumps, which might be called "dumping stations," were of much assistance to truck operators in disposing of extra fuel. Furthermore, deliveries were usually made to these agencies once a week. Thus nearby farmers running short of fuel often could be served at the same time.

Occasionally, several routes some distance from the bulk plant were grouped around a cooperative service agency or store to obtain the above-mentioned advantages.

Getting New Patrons and Volume on Routes

The route system used by the cooperatives included in this study has facilitated the building of volume with a minimum of extra mileage by trucks. Before the war a definite program was used by managers and farm servicemen in securing new patrons, but during the war all membership and volume solicitation was discontinued to conserve trucks and because most farm servicemen had about all the business they could handle. The prewar program embodied the following practices:

1. Routes were organized so that farm servicemen would call on prospective patrons between deliveries. While the delivery schedule varied each day, each farm serviceman was to make at least 15 calls per day, including deliveries and calls on prospective patrons.

2. A survey book was provided in which farm servicemen listed the names of all farmers, both patrons and nonpatrons, on each of their routes. Each sheet in the book covered roads between certain designated points or crossroads, so that the sheets could be kept in the book in the order in which routes were run. A separate survey book was kept for each week's routes. On alternate weeks, survey books were left at the plant for the manager's use in calling on prospects developed by the farm servicemen.

Appraisal of the Route System

It appears from this study that a well-organized route system provides the most efficient and satisfactory method of operating a farmers' petroleum cooperative in this area. A few employees who had had experience in delivering on an "order" or "call" basis for other oil companies concurred in this opinion. They pointed out that only by means of such a route system could all the small farms be served at a reasonable cost per gallon. Managers and farm servicemen stated that the route system enabled them to give dependable, systematic delivery service to farms at regular, schedules intervals and that such service was more convenient for both the farm servicemen and the farmers. Several farmers mentioned that much of their loyalty to the cooperatives was due to the route system which gave them better service than they had ever had in the past. Satisfaction was expressed by one farmer in the following manner: "The farm serviceman is usually at my place every other Thursday morning within 10 minutes of 10 o'clock and there were few days during the past year when he missed this schedule."

Other advantages of the route system mentioned by managers and farm servicemen are: (1) It helped to control credit as the farmers were seen at regular intervals, (2) it afforded contacts with prospective patrons and the building of volume along with regular deliveries, and (3) it facilitated educational work and other features of membership relations.

The success of routes depends upon the extent to which farm servicemen stay on them and keep on schedule. The value of routes becomes most evident when trucks break down and are off routes 2 or 3 days during good farming weather, and also, when they get off schedule in bad weather. The fewer the telephone calls that come into the office, the better the routes are working.

Efficient delivery operations require that routes be checked and revised constantly to keep up with the changes in farm owners and operators, patrons, prospective patrons, and volume of petroleum business. It is also essential, as discussed later, that each patron's seasonal fuel requirements be analyzed and that he have proper storage capacity.

It is the opinion of the writer that much of the success of these cooperatives has been due to the quality of service rendered and that the service, in turn, has been made possible by the routing system. There is still room for improvement, however, in their delivery systems. As expressed by the director of the Petroleum Management Service, maximum delivery efficiency and service cannot be attained until the plant begins to reach maturity, patrons become more or less stable, and the peak or maximum volume has been attained. Then managers and farm servicemen can transfer patrons from one route to another so that no mileage will be wasted. Under such conditions, routes can be run so that almost at the same hour of the same day every other week the tank truck will be at the member's farm.

Thus, at present there are opportunities to increase patrons and volumes on most routes and eventually to shorten routes. To keep pace with needed revisions in routes, managers and farm servicemen should continually study the performance of patrons, as shown in truck books or route ledgers in the office. It would appear advisible for the manager to spend perhaps a day each week on a truck with one of the farm servicemen. Keeping route maps up-to-date should help in controlling mileage. Lists of patrons by routes each year which show dollar and gallon purchases and loaned equipment should be helpful to district managers and local employees in attaining maximum efficiency.

FACILITIES USED IN DISTRIBUTING PETROLEUM PRODUCTS

The bulk station facilities of the cooperatives were usually on the outskirts of the cities, six were on or near main highways, two were on railroad right-of-way, and two were near railroads. The average original cost of all facilities or fixed assets averaged $23,289 per association on June 20, 1944 (see table 12). The range among the associations was from $17,493 to $33,324. The average depreciated value was $15,370. The average cost value of bulk station facilities was $6,276; of delivery equipment, $7,552; and of farm storage equipment, $9,461 per association.

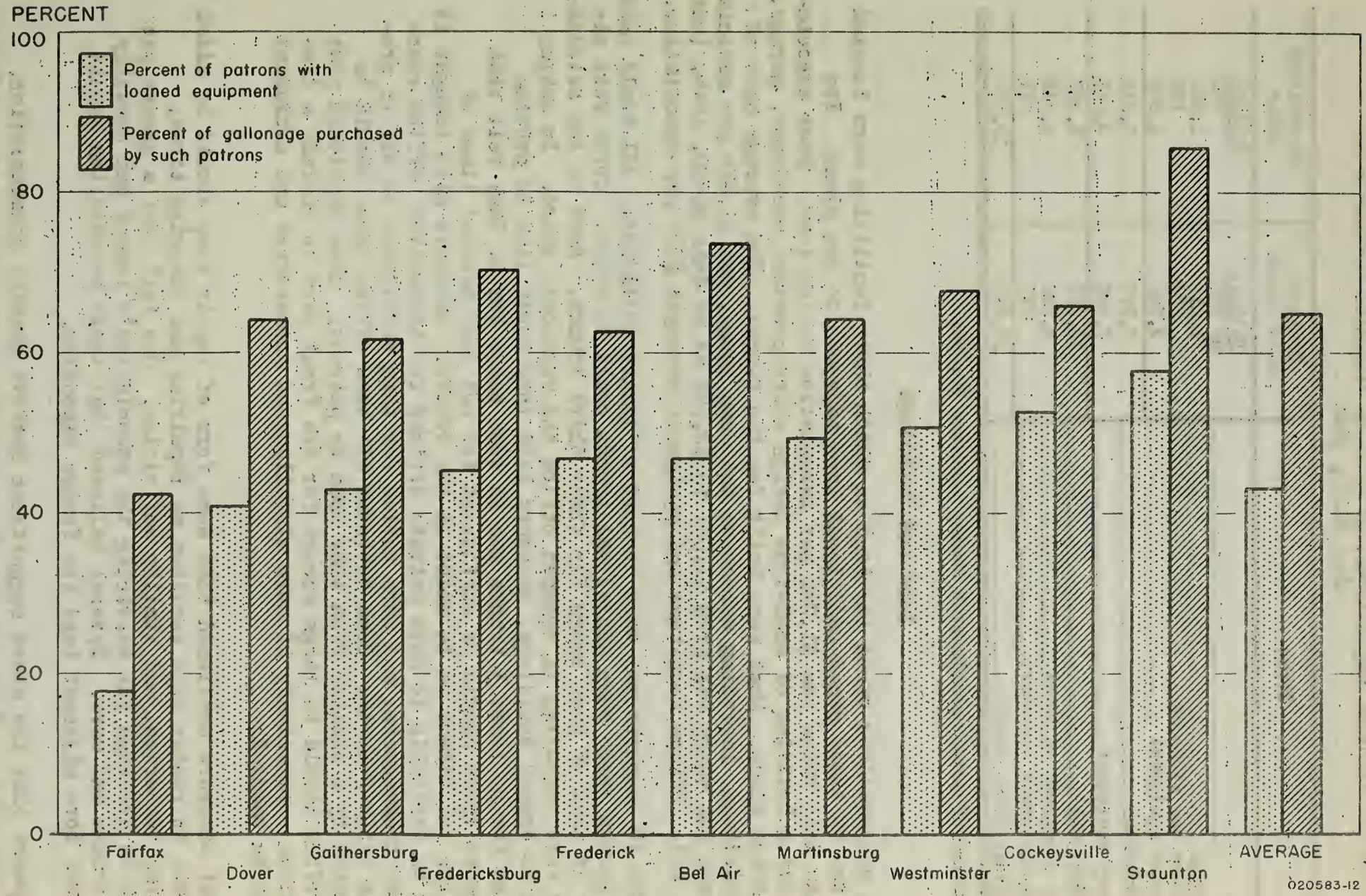


Figure 12. - Percentage of patrons with loaned storage equipment on June 20-30, 1943, and percentage of gallonage purchased by them during the 1942-43 fiscal year, by associations.

Table 12 - Average original cost and depreciated values of fixed assets of 10 petroleum cooperatives, as shown by financial statements on June 20-30, 1944

Items	Original cost value	Depreciated value
	Dollars	Dollars
Land	a/ 841	841
Buildings	1,814	1,221
Furniture and fixtures	374	192
Warehouse equipment	3,247	1,662
Subtotal	6,276	3,916
Delivery equipment	7,552	4,541
Subtotal	13,828	8,457
Loaned equipment on farms	8,890	6,342
Loaned equipment inventory	571	571
Total fixed assets	23,289	15,370

a/ Average of seven associations owning land was $1,202.

Land and Buildings

Seven cooperatives owned the land on which their facilities were located and some of these owned additional land adjacent to the plant. Its average cost value was $1,202 per association owning land. Each association had a building of shed-type design which provided warehouse, garage, and office space. Most were built for two trucks. The average cost of the buildings, including warehouse and pump house, was $1,814 per association and the range was from $1,087 to $2,769 as of June 20-30, 1944, (see table 12). Office furniture and equipment averaged $374 per association.

All the 10 cooperatives were in need of larger buildings. All would need more garage space when additional trucks could be added. Three were already in need of such space for their third trucks. Most of the associations were operating in cramped office and warehouse space. In making plans to expand buildings, managers said they would like to provide storage for at least 3 trucks and in some cases for 4. They felt that warehouse space should be sufficient for not only present lines of supplies but others to be added in the future. Managers also thought it would be desirable to have private offices for themselves, office space for the bookkeepers, and work tables for farm servicemen to use in preparing daily reports. Some believed all this office space should be separated by a counter from that used by patrons. Some mentioned that the office should be large enough for the front part to include a display room - especially if more miscellaneous accessories and equipment should be handled.

Several managers mentioned that some form of repair shop should be added in order to render such services as repairing and changing tires, charging batteries, and similar activities. One felt that a grease pit should be provided for servicing the association's trucks and possibly farm trucks and cars. Several believed that their association should purchase more adjacent land for future expansion.

It appears that the above suggestions deserve careful consideration. While the policy of developing these petroleum associations around bulk

station and delivery service seems to be entirely sound, members during the next 5 to 10 years may want further services and a wider variety of automotive supplies. Therefore, land should be purchased and buildings should be located and planned so that the petroleum business can be expanded or other related services added. Possibilities for expansion are discussed in a later section of this report.

Bulk Tanks and Equipment

Five cooperatives each had one bulk storage tank for gasoline, and five had two tanks each with capacities ranging from 10,000 to 15,000 gallons per tank. All had one tank each for kerosene, with capacity of 10,000 to 12,000 gallons, and six had similar storage tanks for fuel oil. Three had small tanks of 1,000 to 2,000 gallons in size. For refined fuels, two associations had from 20,000 to 29,000 gallons capacity; four had from 30,000 to 39,000 gallons; and four associations had from 40,000 to 49,000 gallons. The average was 35,811 gallons per association. Gallonage handled in 1943-44 was 20.1 times the bulk tank capacity with the range from 10.5 to 36.9 times. A few associations needed more storage for one or more refined fuels - especially if ethyl gasoline were to be handled and if more effort should be devoted to fuel oil business in the future.

Tanks at eight plants were vertical, at one they were horizontal, and at the other all were underground. All tanks were equipped with meters. The gasoline tanks at some plants were equipped with special gauges so constructed that readings on the quantity of fuel contained at any given time could be taken from the ground and thus avoid climbing and opening the tanks for the purpose of "sticking" them to obtain readings. These gauges, which cost about $25, were highly recommended by the managers.

The original cost of bulk tanks, pumps, and meters averaged $3,247 per association. The range was from $2,259 to $4,268 per association.

Regarding desirable bulk station storage for new associations in comparable areas, managers made the following general recommendations: a capacity of 20,000 gallons for regular gasoline; 10,000 to 12,000 gallons each for ethyl gasoline, kerosene, and fuel oil. This would total at least 50,000 gallons for a plant. The managers recommended the enclosure of storage tanks within a heavy wire fence to reduce fire risk and prevent pilferage.

Delivery Equipment

Trucks

The original cost of delivery equipment, including trucks, tanks, pumps, and meters, averaged $7,552 per association on June 20-30, 1944. The 10 associations studied had a total of 24 tank trucks on that date. The average cost for the 2-truck plants was $6,470; for the 3-truck plants, $8,717; and for the 4-truck plant, $12,800. Investments in trucks varied because of their age and condition at time of purchase.

On June 20-30, 1944, 1 cooperative had 4 trucks; 2 had 3 trucks each; and 7 associations had 2 trucks each. All were owned by the associations. Six associations each added a truck during 1941-42; 2 added a truck each in 1942-43; and 1 added a truck in 1943-44. Several associations stated that another truck would be needed as soon as new business and patrons could be handled. Sixteen trucks were G.M.C.'s; 4 were Chevrolets; and 4 were Fords. Most of them had rated capacities of 1 1/2 tons. Only 3 were of the cab-over-engine type and few had dual rear ends or reduction gears. Nine were manufactured during the period 1938-40 inclusive, 11 during 1941, and 4 in 1942.

While most trucks had been driven between 35,000 and 75,000 miles, a number were reported to be in fairly good condition in the spring of 1944. Since several had considerable mileage at the beginning of the war, it has been necessary to repair and completely overhaul some that normally would have been traded in on new trucks. Two traveling "maintenance men" (formerly called traveling mechanics) were employed by Southern States Petroleum Management Service to do as much of this work as possible. Some major overhaul jobs were performed at local garages.

The Southern States Petroleum Management Service has always emphasized the importance of proper care and maintenance of the tank trucks of local associations over which it has had supervision. Records of truck performance, including mileage per gallon of fuel and operating costs per gallon and per mile, have been kept on each truck. Since the war, farm servicemen have been urged to drive slower and more carefully; to check tires, mechanical parts, and oil gauges more frequently; to avoid bad roads on which the trucks might become stuck or overheated; and to take all other precautions that would prolong the life of the trucks.

From the beginning, the Management Service has sponsored a safety program. Safety rules which employees are required to follow in the performance of their duties are listed in a handbook of instructions called the "Petroleum Handbook." These safety instructions include 18 items pertaining to the warehouse; 15 on the pump house; 14 on storage tanks; 8 on the loading of tank trucks; 15 om making farm deliveries; and 13 general rules or instructions. A cafe driving contest is held each year for farm servicemen. Plant managers report on a special form each accident to the Southern States Petroleum Management Service. Each is reviewed by a Plant Manager's Committee at its regular meeting, and on the basis of facts presented, the accident is classified as avoidable or unavoidable. Awards are made to those employees having no avoidable accidents during specified periods as follows: One year - a safe driving certificate; 2,3, and 4 years - honor driver's certificates; and for 5 years - a pin for skillful driving. Placards are posted in each plant showing the monthly status of each farm serviceman. Safety literature is mailed monthly to all employees to encourage safe driving and fuel handling practices.

Managers in the rougher areas were of the opinion that 2-ton trucks with dual rear ends would be the best size to acquire after the war. Those in the more level areas thought a 1 1/2-ton heavy duty truck was satisfactory even though slightly larger tanks might be obtained in the

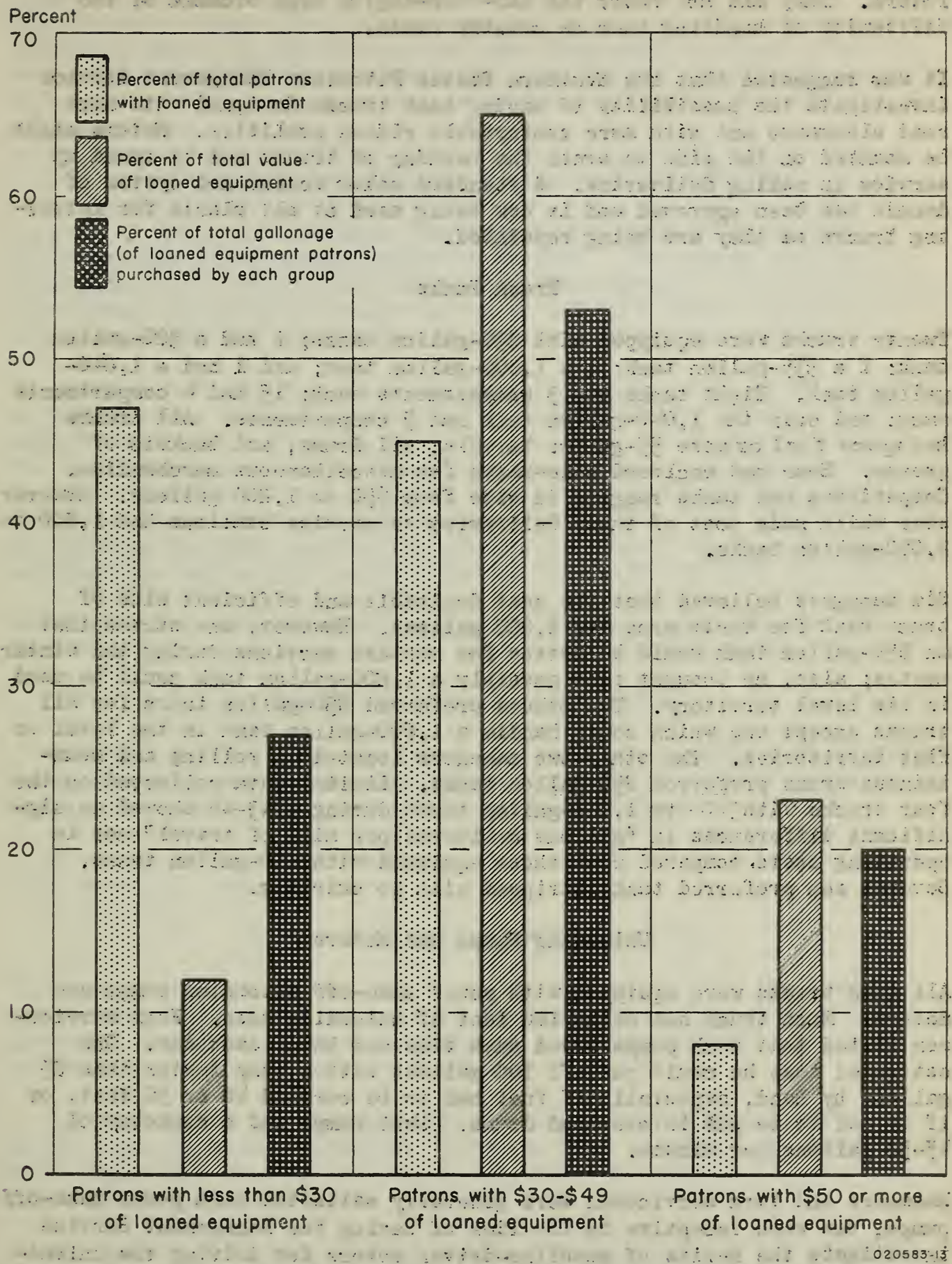


Figure 13. - Loaned equipment held by patrons on June 20-30, 1943, and gallonage purchased by each group during the 1942-43 fiscal year.

future. They did not favor the cab-over-engine type because of the difficulty of handling them on country roads.

It was suggested that the Southern States Petroleum Management Service investigate the possibility of having tank trucks designed with more road clearance and with more comfortable riding qualities. Meters might be mounted on the side to avoid the backing of trucks and to speed up service in making deliveries. A standard color scheme and system of decals has been approved and is now being used at all plants for lettering trucks as they are being repainted.

Truck Tanks

Twenty trucks were equipped with 850-gallon tanks; 1 had a 920-gallon tank; 1 a 935-gallon tank; 1 a 1,000-gallon tank; and 1 had a 1,040-gallon tank. Eight tanks had 3 compartments each; 15 had 4 compartments each; and only the 1,040-gallon tank had 5 compartments. All trucks had space for 1 or more 55-gallon barrels, oil drums, and buckets of grease. Some had enclosed side-racks for miscellaneous merchandise. Competitors had tanks ranging in size from 650 to 1,200 gallons. However, some which made most of their deliveries to service stations had 1,800 to 2,000-gallon tanks.

Six managers believed that the most desirable and efficient size of truck tank for their area was 1,000 gallons. However, one stated that an 850-gallon tank would be better for certain sections during the winter months; also, he thought that possibly a 1,200-gallon tank could be used in his level territory. Two others preferred 850-gallon tanks for all trucks except one which could handle a 1,000-gallon tank in the level or flat territories. The other two managers located in rolling and mountainous areas preferred 850-gallon tanks. Limited data collected on the four trucks with 920- to 1,040-gallon tanks during 1943-44 showed no significant differences in "gallons delivered per mile of travel" nor in operating costs, compared with those equipped with 850-gallon tanks. Several men preferred tanks stripped with no skirting.

Unloading Pumps and Meters

All tank trucks were equipped with power take-off unloading pumps and meters. Each truck had about 100 feet of unloading hose. Farm servicemen stated that such pumps saved much time and labor each day. One estimated that he could put off 100 gallons with a pump faster than 25 gallons by hand, especially if fuel had to be carried 40 or 50 feet, or if it had to be put in overhead drums. Most pumps had a capacity of 45-50 gallons per minute.

Managers and farm servicemen were generally satisfied with power take-off pumps, but were receptive to the idea of having the Management Service investigate the merits of gasoline-driven motors for driving the unloading pumps. One manager said he liked predetermined meters which can be set to automatically cut off at any desired quantity, thus giving farm servicemen more time to arrange barrels, make out tickets, talk with farmers, and show them automotive supplies or accessories. Two others

said that an extra pump, meter and 100 feet of hose for kerosene would save a lot of time - possibly as much as 3 hours per day as compared with unloading cans. It was pointed out that frequently kerosene drums are mounted on overhead racks to facilitate use with brooders, and therefore difficult to fill by hand. Also, such equipment would make the use of kerosene safer.

Preventive Maintenance Program for Tank Trucks

On July 1, 1944, a maintenance department was established by the Southern States Petroleum Management Service. Its duties include the development of a truck preventive maintenance program; the purchasing of new trucks; planning and construction of new bulk plants; remodeling of old plants; and the supervision of loaning farm storage equipment.

In addition to embodying the conservation practices and safety programs already in use, a modified form of the General Motors standard truck preventive maintenance plan was put into practice. This system provides for the two important phases of scientific maintenance: (a) Performance of required maintenance operations at specific intervals and mileages; and (b) accumulation of operating and maintenance data. The objectives are to increase the life span of the present equipment and to keep costs per mile and per gallon at a minimum during the entire life of the vehicle.

As adapted to petroleum tank truck operation, the plan includes the following types and basic periods of preventive maintenance:

Service by Bulk Plant Employees

1. Each day the farm servicemen are required to examine their trucks. Brakes, lights, motor, and other parts are to be tested for operation or leaks. Gas, oil, water, and tires are to be checked.

2. Each Saturday the trucks are given a complete lubrication and a more thorough check-up.

Service by Traveling Maintenance Men

Five types of maintenance service are to be performed by the traveling maintenance men who are employed by Southern States Petroleum Management Service. The services are scheduled at specified intervals or mileages as outlined in the following paragraphs:

1. Each month the traveling maintenance men give each truck a complete check-up and lubrication. Items in need of repair are listed and adjustments are made of such operating parts as carburetors, spark plugs, and timing equipment.

2. Each 5,000 miles, the maintenance men perform all the monthly services listed above plus others such as checking and adjusting wheel alignment, brakes, generators, grease retainers, and bearings, and cleaning crankcase ventilators.

3. Each 10,000 miles, the maintenance men perform the services listed under items (1) and (2) and also replace inexpensive minor parts. Certain concealed units are opened and adjusted. The cooling system is cleaned, valves ground, and springs replaced, and the fuel pump is overhauled or exchanged. Distributor points, rotor, condenser, and high tension wires are arbitrarily replaced.

4. Each 15,000 miles, the services listed under items (1), (2), and (3) are performed plus work on the transmission and differential, clutch, spindle bolts, universal joints and center bearings, wheel bearings, brakes, and a general reconditioning of the engine.

5. Each 30,000 miles the fifth type of service includes the installation of a factory remanufactured engine, or a complete engine overhaul for those vehicles whose manufacturers do not offer an exchange engine service.

Work sheets for each of the five services are filled in by the traveling maintenance men after completing the work on each truck. From these data, a "preventive maintenance service record" on all trucks is kept in the office of the Petroleum Management Service. A large wall chart provides a coded running or daily record of all mechanical work performed on each truck. The main items recorded are mileage, date, work performed, the maintenance man assigned, and work order reference number. Regular repairs appear in black, repeat work in green, and all accident work is coded in red. Thus, frequency of service, inefficient repairs, and road failures are all visible on this master chart.

Supplementing this service record sheet is a "history record" on each truck. It indicates the replacement period of those units which experience proves should be treated individually. It constitutes a "repair-before-failure" type of maintenance system. For instance, if a clutch failure occurs at approximately every 20,000 miles, then replacements can be scheduled every 18,000 miles, thus avoiding costly repairs and road failures.

Under this new system, detailed cost records will show the amount spent on transmissions, clutches, brakes, valves, pistons, and similar units. Likewise, all other types of operating expenses will be kept in detail on each truck so that comparisons can be made between trucks of different makes and between those in various associations. This preventive maintenance program will also include care and maintenance of tires to aid in obtaining low tire cost and long road service. Control of tires will be handled through complete life history tire records. An inventory of tires and repair parts will be maintained at one or two plants in the territory.

It is the hope of the maintenance department that this program will enable the traveling maintenance men to devote most of their time to maintenance service rather than repair and overhauling work. After the war, consideration may be given to the establishment of a central garage for performing major overhaul jobs on trucks and repair work on tanks. This entire program should result in greatly improved operating efficiency of trucks.

Because of the problems involved in loaning farm storage equipment, such facilities and the use made of them are discussed in the following section of this report.

THE PROBLEM OF LOANING FARM STORAGE EQUIPMENT

The extent of storage facilities for motor fuels on farms is an important factor in the efficient operation of petroleum associations. It affects size of fills, frequency of deliveries, number of extra trips, and the degree to which farm servicemen can stay on regular routes. Managers reported increases ranging from 10 to 33 percent in petroleum storage on farms during the last 5 years. Most of this increase grew out of the equipment-loaning activities of the associations, although since the beginning of the war cooperatives have encouraged farmers to purchase additional storage. The demand from farmers has been considerable because of their desire to keep as much fuel on the farm as possible as a safeguard against a general fuel shortage in the area. However, storage enlargement was limited by the equipment available and the wartime regulations for handling it.

Equipment Owned by Patrons

Records of 10 associations on June 20-30, 1943, showed that approximately 329 gasoline and kerosene patrons per association owned all their farm storage equipment for motor fuels (see table 13). This group represented 52 percent of the total of 630 patrons per association, including stores and agencies. The range among the group was from 42 to 72 percent (see Appendix, table 27). This group, however, purchased only 29 percent of the gasoline and kerosene handled by the cooperatives during the 1942-43 fiscal year, with the range from 15 to 58 percent. Purchases per patron averaged $88 and 471 gallons of gasoline and kerosene. Patrons purchasing only fuel oil, motor oil, or accessories and service agencies and stores who owned all their equipment represented another 4.5 percent of total patrons and they purchased 3.3 percent of the total volume of business (see table 13).

Practically all of the storage equipment owned by farmers consisted of 55-gallon drums because the larger equipment could be borrowed from the cooperative if the volume justified it. A few associations reported that they had sold a limited number of 270-gallon underground tanks to farmers during the past 5 years. The selling basis varied among associations, but most equipment was secondhand and sold at its depreciated value. Special effort was made to sell tanks to farmers who wanted to borrow too large a tank in relation to their volume and to sell those tanks not being used to full capacity on farms.

Equipment Loaned to Patrons by Cooperatives

There were on the average 270 gasoline and kerosene patrons per association (exclusive of service stores and agencies) who were borrowing all or a part of their storage equipment from their cooperatives. They represented 43 percent of all patrons, including stores and agencies. The range of such patrons among associations was from 18 to 58 percent.

Table 13 - Summary of purchases by patrons based upon ownership of storage facilities in 10 petroleum cooperatives during the fiscal year ended June 20-30, 1943

Type of patrons and equipment	Patrons served		Value of loaned equipment a/		Total fuel and merchandise purchased		Gasoline and kerosene purchased	
	Number	Percent	Dollars	Percent	Dollars	Percent	Gallons	Percent
Gasoline and kerosene patrons with loaned equipment b/	2,700	42.9	70,359	92.3	649,655	64.3	3,610,509	64.7
Gasoline and kerosene patrons with own equipment b/	3,291	52.3	-	-	291,046	28.8	1,551,338 c/	27.8
Service agencies with loaned equipment d/	20	.3	5,438	7.1	36,695	3.6	273,956	4.9
Service agencies with own equipment d/	15	.2	-	-	23,403	2.3	147,227	2.6
Other patrons e/	269	4.3	434	.6	10,182	1.0	-	-
Total f/	6,295	100.0	76,231	100.0	1,010,981	100.0	5,583,030	100.0

a/ Seventy-one nonpatrons with $982 of loaned equipment and the Augusta Farm Bureau Cooperative Association, Staunton, Virginia, with $3,354 of loaned equipment not included, thus the grand total of all loaned equipment was $80,567. These totals do not agree with those shown on the balance sheets of the associations because of other nonpatrons having equipment and small amounts unaccounted for in equipment ledgers.

b/ Exclusive of service agencies and stores.

c/ Includes one patron with gallonage but no dollar volume listed.

d/ Dollar volume accounting for some agencies and stores handled directly with head office of the wholesale. Neither gallonage nor dollar volume shown for some of the service stores. Volume supplied to the Augusta Farm Bureau Cooperative Association is not included.

e/ Patrons purchasing only fuel oil, motor oil, or other merchandise. Includes 30 patrons with loaned equipment totaling $434.

f/ These volumes will not check with those compiled from operating statements because of fuel used in association trucks, fuel transferred from one association to another, and other indicated amounts not included.

This group purchased 65 percent of the gasoline and kerosene gallonage with the range from 42 to 85 percent (see figure 12 and table 13). This group of patrons had an average of $26 worth of equipment per patron, or a total of $7,036 per association, in June 1943. The range was from $18 to $35 per patron. Service agencies and stores and a few patrons purchasing only fuel oil, motor oil, or accessories who had borrowed equipment represented less than 1 percent of total patrons and their dollar volume of business was less than 4 percent of the total.

The cost value of loaned equipment outstanding to all persons, service agencies, and stores on June 20-30, 1944, averaged $8,890. The inventory at plants averaged $571, thus making a total of $9,461 per association. For data on individual associations, see Appendix, table 27. The original or contracted costs of equipment varied within and among associations because much of it was used equipment when purchased from other

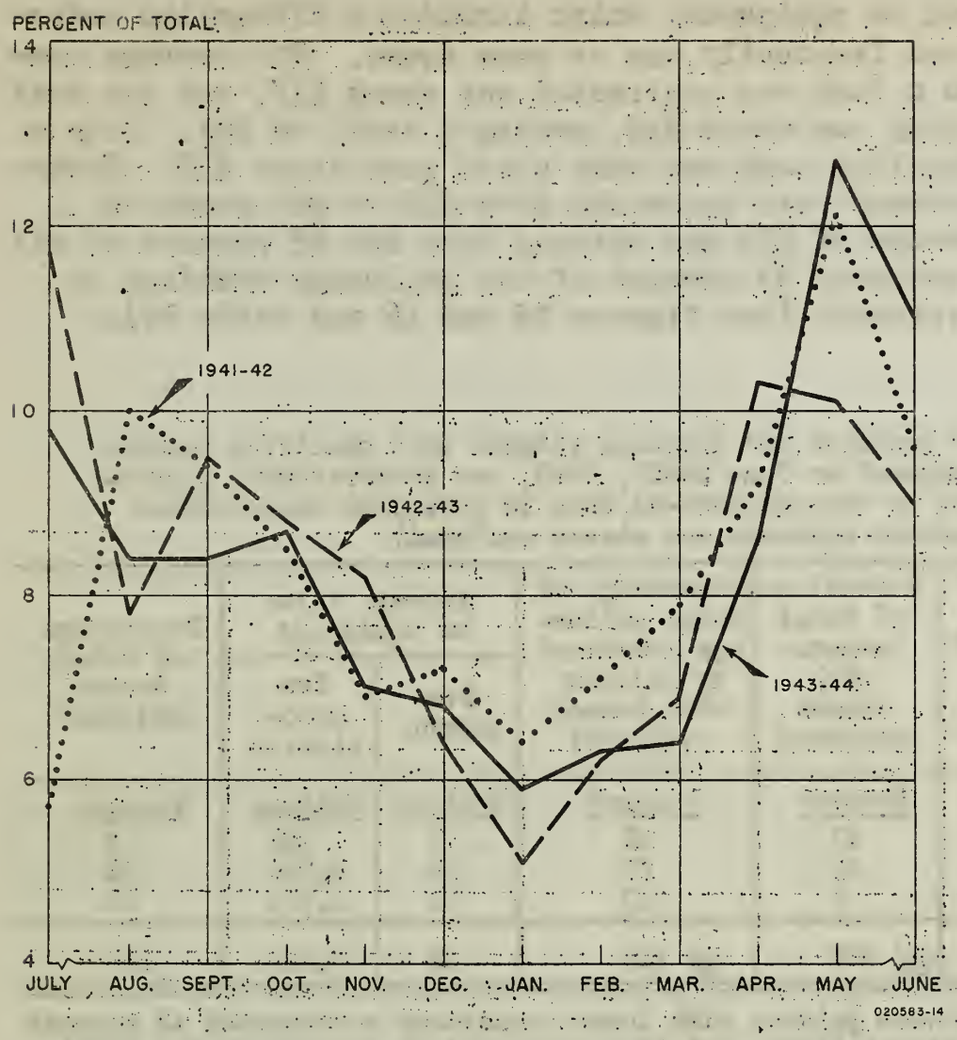


Figure 14. - Average percentage of gasoline purchased monthly by patrons of 10 petroleum cooperatives, 1941-42 to 1943-44.

companies who had been supplying the farmers; the necessary amount of piping and fittings varied; some tanks were equipped with pumps of different sizes or with visible bowls; installation costs of $3 to $5 per tank were included by two associations; and variations occurred in the valuation of equipment which had been transferred from one farm to another. (However, the use of original cost rather than depreciated value facilitated the classification of tanks of similar size). In the installation of tanks, farmers were usually required to dig the holes and the farm servicemen installed the tanks. In some cases, where farmers could hire the holes dug at a reasonable price, the cooperatives would reimburse them.

The principal types of equipment loaned to patrons (exclusive of agencies and stores) as of June 20-30, 1943 were classified into the following groups:

1. Less than $30 worth of equipment, which usually consisted of 55-gallon drums and a few 110-gallon tanks. Such a drum and faucet was usually contracted for at a prewar cost of $3 to $4 and a 110-gallon tank and pump was about $27. Forty-seven percent of all gasoline and kerosene patrons with loaned equipment had less than $30 worth of equipment, with an average of $6 per patron; they had 12 percent of the value of all loaned equipment; and they purchased slightly more than one-fourth of the gallonage obtained by loaned-equipment patrons (see figure 13 and table 14).

2. $30 to $49 worth of equipment, which included a 270-gallon underground tank and pump and frequently one or more drums. The average prewar cost at which such a tank was contracted was about $18, and the cost of a 1-gallon-stroke pump was about $19, making a total of $37. Only a few patrons had a 175-gallon tank and pump which cost about $33. Forty-five percent of the patrons with tanks had from $30 to $49 worth of equipment, with an average of $38 per patron; they had 65 percent of all equipment; and they purchased 53 percent of the gallonage obtained by patrons with loaned equipment (see figures 15 and 16 and table 14).

Table 14 - Summary of gasoline and kerosene patrons with specified amounts of loaned storage equipment on June 20-30, 1943, and proportionate gallonage of fuel purchased by them in 1942-43 from 10 petroleum cooperatives (service agencies and stores excluded)

Classification of equipment by cost groups	Number of patrons per association	Percentage of total patrons with loaned equipment	Percentage of total gallonage purchased by patrons with loaned equipment	Average value of equipment		Percentage of total loaned equipment
				Per patron	Per association	
	Number	Percent	Percent	Dollars	Dollars	Percent
Less than $30	129	47	27	6	827	12
$30 to $49	121	45	53	38	4,555	65
$50 or more	20	8	20	81	1,654	23
Total	270	a/ 100	a/ 100	26	7,036	100

a/ Total gasoline and kerosene patrons with loaned equipment represented 43 percent of all patrons of the associations, and they purchased 65 percent of the total gallonage of gasoline and kerosene.

3. $50 worth or more of equipment, which included a 550-gallon underground tank and pump, or two or more 270-gallon tanks and pumps. The average prewar contracted price of the large tank ranged from $35 to $50; the 1-gallon pump was $19; and the 3-gallon pump about $27; thus, the total costs of such units usually was between $60 and $80. This group of patrons constituted only 8 percent of the total number of patrons with equipment, but they had 23 percent of all equipment, with an average of $81 per patron; and they obtained 20 percent of the gallonage purchased by all loaned equipment patrons.

4. Equipment loaned to service stores and agencies, which included various sizes of tanks and equipment, averaged $272 per patron (exclusive of the Augusta Farm Bureau Cooperative Association). Patronage-refund records of the local associations did not include the volume handled by all of these agencies and stores.

The loaning of storage equipment to farmers was a customary practice among the cooperatives and other oil companies in the area studied. Cooperatives believed that they must provide equipment for patrons in order to meet competition and that such a practice had the following advantages:

(a) It aided cooperatives in obtaining patrons and volume of business. Managers generally believed that many farmers would not patronize the cooperative unless it loaned equipment on the same basis as competitors.

(b) It gave the cooperative some degree of control over patrons - it enabled the co-op to get 100 percent of the patrons' business. Some managers contended that loaning equipment aided in holding patrons, while others did not believe it would influence the patron if he were dissatisfied. They pointed out that many patrons owning equipment were just as loyal as those borrowing it.

(c) It helped to improve delivery efficiency as equipment of proper sizes could be placed so that farm servicemen could operate on regular 2-week routes. This reduced the frequency of deliveries and the number of extra trips in many cases, thus keeping truck mileage to a minimum and conserving time of the farm servicemen. Such economies accrued to the associations as all trucks were owned by them.

The main problems and disadvantages of loaning farm-storage equipment were as follows:

1. The investment in such equipment was large - the cost value of the outstanding loaned equipment and inventory per cooperative averaged $9,461 per association, compared with $6,276 for the bulk plant and $7,552 for delivery equipment, as of June 20-30, 1944. Much of the extra capital required for this equipment had to be borrowed and repaid with funds accumulated principally from net savings.

2. The annual costs of loaning farm-storage equipment - especially of the underground type - were large. Such costs, which are discussed in detail later, averaged approximately 13 percent per dollar of equipment. This amounts to $1,170 or almost $100 per month in an association with $9,000 of equipment. On the basis of gallonage handled by cooperatives in 1942-43, these costs were equal to 0.18 cent per gallon of all fuel, and to 0.27 cent per gallon purchased by patrons having the loaned equipment. None of this expense was offset by rental charges.

3. It is unfair or inequitable for patrons owning all their equipment to provide capital for equipment which is loaned to other patrons. While one-half of the patrons borrowing equipment accounted for two-thirds of the total volume, the principle of loaning equipment to them is similar to that of giving volume discounts, neither of which is desirable in a local cooperative.

4. Difficulty of determining satisfactory minimum volume standards on which to base the efficient loaning of various sizes of tanks.

5. Difficulty of refusing equipment to patrons whose volumes do not justify installing it, or of selling or removing underground equipment when purchases by patrons fall below the minimum requirements.

6. The problem of getting the consent of absentee landowners to install equipment on their farms for use of the tenants; or of getting verifications from them at a later date.

Policies and Procedures for Loaning and Controlling Equipment

Because of the large investments in farm-storage equipment by the cooperatives, it is important that a definite system be used in placing such loaned equipment on farms where the volume will be sufficient to justify the investment. It is equally important to have a strict and systematic plan for controlling and accounting for the equipment after it has been installed on farms. The Southern States Petroleum Management Service, therefore, has adopted policies regarding the loaning, use, maintenance, purchase, sale, removal, accounting, and control of loaned equipment. These are set forth in detail in an employees' petroleum handbook under the following topics:

1. Applications for Equipment. - Information is obtained regarding the size and type of farm, the size and type of power equipment used on the farm, and its annual petroleum requirements. Applications must be made for both new and used tanks, but not for drums.

2. Minimum Gallonage Requirements for Various Types of Equipment. - The following set of annual volume standards, considered the minimum necessary to justify loaning various types of equipment, are used:

Type of equipment:	Minimum annual gallonage required
550-gallon underground tank with 1-gallon stroke pump	2,500
270-gallon underground tank with 1-gallon stroke pump	1,500
175-gallon above-ground tank with rotary pump	1,200
110-gallon above-ground tank with rotary pump	1,000
55-gallon drum for kerosene	550

No minimum has been set for loaning drums for gasoline. Tanks and pumps are not loaned for the storage of kerosene and fuel oil. On the basis of the average price per gallon of gasoline and the average prewar cost of equipment, about $7 worth of fuel must be sold annually for each $1 of loaned equipment to attain the standards established for the tanks.

3. Equipment Contracts. - An equipment contract is required for each piece of equipment loaned and for each transfer of equipment. Where equipment is loaned to tenants, a landowner's consent clause is provided in the contract. A ledger kept at each plant shows data on loaned equipment and number and type of contract.

4. Purchasing from Other Suppliers Equipment Installed on Farms. - In cases where patrons of private companies become patrons of the cooperatives, procedure is outlined for purchasing any type of equipment on such patrons' farms which belongs to the private suppliers.

5. Selling Equipment to Another Supplier. - Information is included regarding the procedure to be followed when a cooperative patron decides to change from a cooperative source of supply to a private source.

6. Control of Loaned Equipment on Farms. - The control of and accounting for such equipment is handled through applications for equipment, contracts, equipment ledgers, and annual inventories. During 1944-45, the cooperatives took a detailed inventory of loaned equipment on farms for a reconciliation of the loaned equipment ledgers. Such inventories are to be taken every 2 or 3 years by farm servicemen on their regular routes - usually during November and December.

7. Removing Unprofitable Equipment from Farms. - Detailed procedure is outlined whereby the director of the Petroleum Management Service obtains from patronage refund records annually the names of patrons who have not purchased the minimum volume required for each type of equipment. These patrons are classified into two groups: (1) those whose purchases are so small that the equipment must be removed and (2) those whose purchases are below minimum requirements, but still large enough to justify an attempt by the local manager to have them increase their patronage.

Analysis of Loaned Equipment in Relation to Patrons' Purchases

With the object of determining the use being made of loaned equipment and whether the volume standards were reasonable, an analysis of gallonage and dollar purchases by patrons having various types of loaned equipment was made for the fiscal year ended June 20-30, 1943. Such equipment was classified into the three value and type groups previously mentioned. All data were obtained from patronage-refund records.

The following variations and characteristics of the data should be taken into consideration:

1. As already stated, the cost value of loaned equipment among the associations varied considerably. The capacity in gallons of the loaned equipment was not obtained.

2. The dollar volume of purchases included all types of merchandise, but motor fuels and oils made up slightly over 96 percent of the total.

3. Gallonage for both gasoline and kerosene was used because in many cases equipment was loaned for both fuels. Kerosene accounted for only 10 percent of the total volume of business.

4. Annual purchases by some patrons were small because they had tanks only part of the year, or because they may not have been patrons the entire year but had possession of tanks purchased by the cooperative from the previous supplier when they joined the association.

5. No information was obtained on equipment owned by those patrons who had also borrowed equipment.

6. Service agencies and stores; patrons purchasing only oil, grease, or supplies; and nonpatrons with loaned equipment were excluded or shown separately in the analysis. Therefore, the total amount of loaned equipment for associations in this analysis will not check with amounts shown on their balance sheets as of June 20-30, 1943.

Table 15 - Gallons of gasoline and kerosene and total dollar volume purchased by patrons in relation to value of loaned storage equipment in 10 petroleum cooperatives, during the fiscal year ended June 20-30, 1943

Range in value of loaned equipment and gallonage purchased per patron	Patrons per association	Average annual purchases per patron a/		Value of loaned equipment per patron	Average annual purchases per dollar of loaned equipment	
	Number	Gallons	Dollars	Dollars	Gallons	Dollars
Less than $30 of equipment:						
Less than 500 gals.	53	242	41.26	4.74	51	8.71
500 - 999 gals.	41	714	121.84	6.30	113	19.33
1,000 - 1,499 gals.	19	1,210	204.69	8.11	149	25.23
1,500 - 2,499 gals.	13	1,842	324.29	10.50	175	30.88
2,500 gals. and over	3	3,500	636.35	10.22	342	62.27
Total or average	129	775	133.88	6.45	120	20.76
$30 - $49 of equipment:						
Less than 1,000 gals.	34	628	121.98	36.97	17	3.30
1,000 - 1,199 gals.	14	1,093	206.58	37.03	30	5.58
1,200 - 1,499 gals.	21	1,347	239.53	37.19	36	6.44
1,500 - 1,799 gals.	15	1,635	293.67	37.54	44	7.82
1,800 - 2,099 gals.	11	1,946	345.65	38.24	51	9.04
2,100 - 2,499 gals.	10	2,268	402.42	37.51	60	10.73
2,500 gals. and over	16	3,622	644.76	39.29	92	16.41
Total or average	121	1,575	284.82	37.55	42	7.59
$50 or more of equipment:						
Less than 1,500 gals.	5	941	195.42	68.54	14	2.85
1,500 - 2,499 gals.	5	2,001	381.19	66.40	30	5.74
2,500 - 2,999 gals.	2	2,743	561.62	87.96	31	6.38
3,000 - 3,499 gals.	1	3,173	577.74	76.57	41	7.55
3,500 gals. and over	7	6,583	1,207.02	100.18	66	12.05
Total or average	20	3,474	651.59	81.46	43	8.00
All groups	270	1,337	240.61	26.06	51	9.23
Service agencies and stores	2	13,436	2,038.62	268.36	50	7.60
Recapitulation of gallonage-purchased groups b/						
Less than 1,000 gals.	130	498	89.39	14.87	33	6.01
1,000 - 1,499 gals.	56	1,231	219.95	29.09	42	7.56
1,500 - 2,499 gals.	54	1,896	339.10	33.59	56	10.10
2,500 gals. and over	30	4,231	768.67	55.93	76	13.74

a/ Gallons include gasoline and kerosene only. Dollar volume includes all fuels and miscellaneous merchandise.
b/ Service agencies and stores excluded.

The following discussion of purchases by patrons with loaned equipment is based on table 15. It is divided into the following groups of patrons having specified types of equipment.

Total Patrons With Loaned Equipment - The 270 patrons per association (exclusive of service agencies and stores) having loaned equipment purchased an average of 1,337 gallons of gasoline and kerosene and $241 worth of all business per patron during 1942-43 (see table 15). This was an average of 51 gallons and $9.23 of purchases per $1 worth of loaned equipment. Almost half of the patrons purchased less than 1,000 gallons. The range among associations was from 27 to 71 gallons and from $7.58 to $12.22 per $1 worth of equipment (see table 16). The variation among associations was due primarily to variations in percentage and performance of patrons having 55-gallon drums (less than $30 worth of equipment).

Table 16 - Patrons' annual purchases per dollar of loaned equipment, by specified types of equipment, and by cooperatives, for the fiscal year ended June 20-30, 1943

Location of association	Average annual purchases per dollar of equipment			
	All patrons with loaned equipment	Patrons with less than $30 of equipment	Patrons with $30 - $49 of equipment	Patrons with $50 or more of equipment
	Dollars			
Frederick, Md.	12.22	25.26	8.80	8.53
Westminster, Md.	10.62	25.76	8.14	7.83
Martinsburg, W. Va.	10.29	18.33	7.22	12.11
Dover, Del.	10.13	23.30	7.72	6.93
Fredericksburg, Va.	9.11	22.11	7.11	9.29
Cockeysville, Md.	8.89	22.19	7.00	8.68
Garthersburg, Md.	8.49	14.59	7.82	8.29
Staunton, Va.	8.37	21.10	6.71	5.81
Bel Air, Md.	8.16	17.14	7.95	5.75
Fairfax, Va.	7.58	12.53	7.21	6.59
Average	9.23	20.76	7.59	8.00

Patrons With Less Than $30 Worth of Equipment (Mostly 55-Gallon Drums) - This group of 129 patrons per cooperative, each with an average of $6.45 of equipment (approximately two 55-gallon drums) purchased an average of 775 gallons of gasoline and kerosene and $134 worth of all business per patron during 1942-43 (see table 15). This was equal to 120 gallons and about $21 of business per $1 worth of loaned equipment, and equivalent to about 7 gallons of volume per gallon of storage capacity, although some of this volume no doubt went through drums that were owned by the patrons. There was wide variation among associations - from $12 to $26 and from 59 to 149 gallons of purchases per $1 worth of equipment (see table 16). It is noted that 53 patrons per cooperative (about 40 percent of this group with loaned drums) purchased less than 500 gallons per year - an average of 242 gallons each.

Data were not obtained on the amount of storage owned by the entire group of patrons borrowing less than $30 worth of equipment. No doubt some of the 16 patrons per association purchasing more than 1,500 gallons annually owned other drums or a tank.

It was impossible to establish from these data a minimum volume requirement or standard of performance for this group of patrons and equipment because of other storage facilities which they owned; and because of wide variations in their purchases and in the number of drums borrowed. It appears, however, that 550 or 600 gallons of kerosene per year for a 55-gallon drum is a reasonable standard. This volume would equal at least 100 gallons or more of fuel and $18 of business per $1 of equipment based upon costs of equipment in these data. Lower volumes may be justified in cases where considerable travel is saved. Dollar volume would vary depending upon the type of fuel - whether it was gasoline or kerosene. While such patrons are customarily served on 2-week routes, many small users are served on a monthly basis, thus the above standard would be equivalent to 12 deliveries of 45 to 50 gallons each.

Patrons With $30 to $49 Worth of Equipment (270-Gallon Tanks) - An average of 121 patrons per association (45 percent of all patrons with loaned equipment) each had borrowed equipment with an average cost value of $37.55. It is this group which represents the main problem in loaning equipment as about 65 percent of the value of all loaned equipment was concentrated here. These patrons each had average annual purchases of 1,575 gallons of fuel and $285 worth of business - equal to 42 gallons and $7.59 per $1 worth of loaned equipment (see table 15). This represented 5 to 6 gallons of volume per gallon of storage capacity, depending upon the number of drums in this group of equipment. The relatively small range in associations is shown in table 16 wherein 7 of the 10 associations showed purchases of from $7 to $8 per $1 worth of loaned equipment.

Much of this equipment was not being used efficiently in 1942-43. There were 34 patrons per association who purchased less than 1,000 gallons of fuel with an average of only 628 gallons each. Then there were 14 patrons purchasing between 1,000 and 1,199 gallons and another 21 purchasing between 1,200 and 1,499 gallons annually. Thus, a total of 69 patrons (57 percent of this group) were buying less gasoline and kerosene combined than the recommended minimum standard of 1,500 gallons of gasoline per year and $7 of volume per $1 worth of equipment for 270-gallon tanks. However, kerosene represented only a small part of this volume.

An average of 16 patrons per cooperative each purchased more than 2,500 gallons - the minimum required for 550-gallon tanks. Their average volume was 3,622 gallons. The possibilities of placing larger tanks or additional tanks among some of them should be investigated unless they now own other facilities.

It should be remembered that the foregoing data apply to a period of wartime fuel rationing. Many patrons with tanks who purchased less than 1,500 gallons of gasoline in 1942-43 may use considerably larger amounts in peace-time, particularly in their automobiles. Some tanks were in the hands of patrons who have greatly reduced such activities as hauling, rock-quarrying, or log-sawing during the war. Also, some patrons with tanks are now working in nearby war industries, but they plan to resume farming after the war. Therefore, most of these tanks have not been removed even though they are not being used on an efficient basis at present.

Should the present minimum standard be raised or even left at 1,500 gallons per year, it appears that these associations will have considerable work to do in getting efficient use of their 270-gallon tanks even though some patrons increase their consumption after the war. It should be recognized, however, that the present status of such equipment is not the fault of many of the present employees. Nevertheless, it indicates the problem before them and for which it is their responsibility to improve. Although many patrons with tanks were purchasing less than the required minimum, a later section indicates that the minimum volume standards for a 270-gallon tank should be raised to 1,800 or 2,000 gallons per year.

Patrons With $50 Worth or More of Equipment (550-Gallon Tanks) - Only 20 patrons per association (8 percent of those with loaned equipment) comprised the group having one 550-gallon tank and pump, or two 270-gallon tanks and pumps, and frequently some drums. The average cost of such equipment loaned to each patron was $81. Their average annual purchases were 3,474 gallons of gasoline and kerosene and $652 per patron - equal to 43 gallons and $8 per $1 worth of loaned equipment (see table 15). This was equivalent to approximately 6 gallons per gallon of storage capacity. It will be noted, however, that one-half of these patrons fell below the minimum requirement of 2,500 gallons of gasoline per year, and one-fourth purchased less than 1,500 gallons. Certainly these tanks are not being used efficiently. However, there were 7 patrons each of whom purchased an average of 6,583 gallons during the same period.

As pointed out in the next section of the report, it appears that a minimum volume of 3,600 to 4,000 gallons per year should be used for these tanks. A volume of at least 3,000 gallons is necessary if a ratio of $7 of business per $1 of equipment is to be attained. This would bring it in line with the 1,500-gallon requirement for the 270-gallon tank. The average of purchases of patrons with the 550-gallon tanks was about 2 1/4 times more than the purchases of those with 270-gallon tanks during 1942-43.

Service Agencies and Stores With Loaned Equipment - The data on 18 cooperative service agencies and stores (with the exception of the Augusta Farm Bureau Cooperative Association) served by the 10 associations showed that each handled an average of 13,436 gallons of fuel and $2,039 of volume through loaned equipment having an average value of $268 (see table 15). This was equal to 50 gallons and $7.60 of business per $1 worth of equipment. The range among the group was from 20 to 70 gallons and from $3 to $12 of purchases per $1 of equipment.

A more complete and satisfactory analysis of the use of loaned equipment could be made by obtaining the gallonage capacity of each piece of equipment and the kind and volume of fuel put through it each delivery as well as the total for the year. Furthermore, the same data should be obtained on any equipment owned by the patron.

It is evident from the foregoing analysis that efficiency of the associations can be greatly improved by getting better use made of the

outstanding loaned equipment. Even though the present volume standards may appear to be low and somewhat less than those used in other sections of the country, if the purchases of all patrons with loaned equipment could be raised to the present standards, the associations would show lower handling expenses per gallon and greater net savings.

Determination of Volume Standards for Loaning Equipment

Cooperatives engaged in the loaning of farm storage equipment for petroleum products are faced with the practical problem of determining standards for the efficient loaning of tanks of various sizes. Among the factors to be considered in determining such standards are the following: (1) The annual costs of loaning equipment; (2) the annual volumes put through tanks; (3) the peak quantity of fuel used by a patron during the 2-week intervals at which routes are covered; (4) the savings in delivery trips, time, and expense that will be effected, and (5) practices of competitors.

Annual Costs of Loaning Equipment

In view of the investment in equipment, the annual costs or expenses of loaning it are an important consideration. The principal item of expense is depreciation. The annual rate now charged by the cooperatives included in the study is 8 percent on the cost value compared with the previous figure of 10 percent. No depreciation is charged on equipment inventory carried at the bulk plant. Using the quarterly average cost value of loaned equipment during the 1942-43 fiscal year of $8,753 per association, annual depreciation expense averaged $700 per association.

Next in importance is interest expense. The cooperatives have been borrowing funds to finance operations and facilities in much greater amounts than the cost of farm storage equipment. In June 1944, all except one still had indebtedness greater than the depreciated value of its farm storage equipment. These funds have been borrowed from Southern States Cooperative at the rates of 4 percent per annum on short-term and 5 percent on long-term loans. Therefore, interest expense for the 1942-43 fiscal year was computed at the rate of 5 percent on the depreciated value of the equipment which averaged $7,073 per association during the year, thus giving an interest expense of $354.

The average original cost of $8,753 per association was not used because the $1,680 reserve for depreciation could have been applied on indebtedness, or invested in stock of the wholesale from which dividends of 4 or 6 percent could have been earned. During the life of the equipment, interest paid would vary among the associations' because of the amounts borrowed to finance equipment and the length of time they were borrowed. Usually annual interest on investment is figured on one-half the original cost of the equipment and thus would have amounted to $219 per year.

Installation costs of a 270-gallon underground tank with a 1-gallon stroke pump have been figured in the past at approximately $3, but it is the policy now to disregard such costs except as they affect delivery expenses of farm servicemen. Even if tanks were all being sold to

farmers, the farm servicemen would usually help them with the installation. Where equipment on a farm was purchased from another oil company, installation costs were included in the sales price. In the past the equipment has usually been shown at actual net cost rather than market value, and since it was the duty of the employees to help install equipment, any out-of-pocket expenses were added to the original contract.

Removal expenses would be important for underground tanks - approximately $8 to remove a 550-gallon tank and $3 for a 270-gallon tank. The cost is based on actual expense, including labor, figured at 7 cents per mile to and from patrons' farms. The percentage that have to be removed is small, especially if tanks are properly loaned.

Maintenance expenses averaged $85 annually per association during the 1942-44 period. This would be equivalent to 31 cents for each of the 270 patrons with loaned equipment, or 60 cents per patron for the 142 having tanks if all the expenses were applied against them. Such expenses included any repairs necessary, such as hoses and pump parts, plus mileage incurred by the local manager in making repairs based on 7 cents per mile. Bookkeeping and inventory costs are disregarded because of the small amounts involved and because this work is done while making deliveries. Loss of equipment is a small item in most associations.

Table 17 - Approximate annual costs per association of loaning all storage equipment and of loaning a 270-gallon tank and pump during the fiscal year ended June 20-30, 1943

Annual loaning costs	Total loaned equipment (Cost = $8,753 and depreciated value = $7,073)	270-gallon tank and pump (Cost = $37 and depreciated value = $30)
	Dollars	Dollars
Depreciation at 8 percent	700	2.96
Interest at 5 percent	354	1.50
Maintenance expense	85	.60
Installation expense	a/	b/
Total	1,139	5.06

a/ If $3 is used for 121 patrons with 270-gallon tanks and $5 for 20 patrons with 550-gallon tanks, this would be $39 per year additional. This would not include removals and re-installation of a few tanks each year.

b/ If $3 per year is used, this would be 25 cents per year additional.

During the 1942-43 fiscal year, equipment loaning costs averaged $1,139 per association (see table 17). With an average of 417,599 gallons of gasoline and kerosene and $73,880 worth of business handled through loaned equipment by patrons (including most of the service agencies and stores) such costs averaged slightly more than a quarter of a cent (0.27 cent or $0.0027) per gallon, and 1.54 percent per dollar of volume. They represented about 13 percent of the original cost or investment. Only $7,915 of the $8,753 of equipment, however, was in the hands of patrons purchasing the above gallonage (the balance was held by nonpatrons and by patrons buying only oil or supplies); therefore, the loaning costs

on this equipment averaged $1,033 per association, which was equal to 0.25 cent per gallon and 1.4 percent on dollar volume.

When the total costs of $1,139 were apportioned over the total 628,451 gallons of gasoline and kerosene and $112,266 of business per association purchased in 1942-43 by all patrons and agencies, they equaled 0.18 cent per gallon and 1.01 percent per dollar of volume. They represented 9.0 and 8.2 percent of the total per gallon and per dollar handling costs, respectively.

Annual costs of loaning a 270-gallon tank and pump were approximately $5.06, equal to 13.7 percent on the original investment (see table 17). The average patron with such a tank purchased 1,575 gallons of gasoline and kerosene and $285 of all business in 1942-43 and such loaning costs equaled 0.32 cent per gallon and 1.8 percent per dollar of volume. On the basis of 90 percent of this gallonage as the gasoline put through the tank, the costs would equal 0.36 cent per gallon. Loaning costs would be $5.41 the first year if funds equal to the original cost of the tank were borrowed. They would be $4.50 per year using interest expense on the depreciated value or about one-half the first cost. Costs per gallon were similar for the 550-gallon tanks.

Annual Volumes Put Through Equipment

Important questions regarding volume standards for loaning of equipment are: (1) What volume must be put through a 270-gallon tank to cover delivery expenses, annual loaning costs, and other overhead expenses? and (2) will reductions in delivery expense as a result of loaning a tank more than offset annual loaning costs? Minimum annual gallonage is a simple standard to use in determining who shall be loaned tanks and in checking the use made of the equipment each year. It has been used by cooperatives in this study and by those in other areas, but it is difficult to determine one figure for general use because of the variations in distance of patrons from the bulk plant and because of variations in their seasonal requirements. Furthermore, if margins are such that a plant has a small net saving per unit, then a greater volume or turn-over would be required to cover annual equipment loaning costs than in a wide margin and net saving plant. Also, it is difficult to determine the effect of loaning equipment on the total volume of the association. Because all associations were loaning equipment to about the same degree and on the same basis, it was not possible to make comparisons with any using different policies and practices.

The present standard of 1,500 gallons for a 270-gallon tank represents a capacity turn-over of 5.5 times and means that annual loaning costs of $5.06 would be equal to about one-third of a cent per gallon or 2 percent per dollar of business. This volume is equivalent to about $255, or $7 of business for each $1 invested in the tank and pump. As indicated by the following data, loaning costs per gallon would decrease as volume put through the tank increases:

Volume	Loaning cost	Volume	Loaning cost
1,000 gallons	0.51 cent	2,000 gallons	0.25 cent
1,500 gallons	.34 cent	2,500 gallons	.20 cent
1,800 gallons	.28 cent	3,000 gallons	.17 cent

The following factors indicate that the standard should be raised to 1,800 or 2,000 gallons for efficient use of 270-gallon tanks:

1. If loaning costs are to be kept down to a quarter of a cent per gallon (the average for all equipment in 1942-43) then 2,000 gallons would be necessary.

2. If loaning costs are not to exceed 10 percent of total handling costs of 2.0 to 2.1 cents, then about 2,400 gallons would be required.

3. It is understood that petroleum cooperatives affiliated with the Cooperative G.L.F. Exchange, Ithaca, New York, use 2,500 gallons as the minimum annual standard for their 280-gallon underground tanks.

4. As discussed in the next section, if the peak month's requirements of a patron are 400 gallons, or 20 percent of his annual total of 2,000 gallons, this could easily be handled with two deliveries, whereas 20 percent of 1,500 gallons is only 300 gallons.

5. The use and cost of drums and 175 or 200-gallon tanks must be considered in establishing minimum volumes to be put through 270-gallon tanks. For instance, if a patron with two or three 55-gallon barrels purchases 100 gallons each 2 weeks during 4 months of the year and only 50 gallons each 2 weeks of the remaining 8 months his volume would total 1,600 gallons. Applying 150- and 75-gallon purchases by a patron with four drums to the above illustration results in 2,400 gallons annually. It appears that a 270-gallon tank should not be loaned where three or four 55-gallon drums will suffice, although in some cases a highly seasonable user requiring a 270-gallon tank may not purchase any more fuel than a steady user would through three drums. On the other hand, for a patron requiring 270-gallons of capacity, it would no doubt be advisable to loan a 270-gallon tank rather than five drums even though the initial cost of the drums would be only about one-half as great. If the cost of 175- or 200-gallon tanks were not so near that of the 270-gallon tank, they should be adequate for most patrons with 1,500 to 2,000 gallons annual volume.

6. A general standard used by cooperatives to indicate efficient use of fixed facilities is that $8 of business should be handled for each $1 of cost value of fixed or capital assets. This would require about $300 of business or 1,800 gallons of gasoline for a 270-gallon tank.

A volume of 2,000 gallons would mean a capacity turn-over of 7.4 times; and a volume of $340, or $9 of business per $1 of equipment. If 2,000 gallons is used for such a tank, then 3,600 gallons for a 550-gallon tank may be sufficient because seasonal requirements would affect its use to a greater extent. It is understood that petroleum cooperatives affiliated with the Cooperative G. L. F. Exchange use 4,000 gallons as the standard for 550-gallon underground tanks.

Factors indicating that the 1,500-gallon standard for 270-gallon tanks and the 2,500-gallon standard for the 550-gallon tanks are satisfactory are as follows:

1. The total handling costs (including equipment loaning costs) on a per gallon and per dollar basis are very reasonable, and the associations averaged 2 percent net savings on local operations in 1942-43 and 3.3 percent in 1943-44. This was accomplished in spite of the fact that half of the loaned tanks had less than the required volumes put through them in 1942-43. It is evident that handling costs would have been somewhat lower if the volume put through all tanks had been up to the minimum standards. Therefore, efforts should be made to get them up to the present loaning standards before raising such standards.

2. Even though it may be advisable to use a minimum volume of 1,800 or 2,000 gallons for a 270-gallon tank, it is not practical to loan 175- or 200-gallon tanks to patrons using from 1,500 to 1,800 or 2,000 gallons per year so long as the tanks are almost the same in cost. Therefore, whereas the 270-gallon tank may be somewhat large for these smaller patrons, the coverage of routes every 3 weeks instead of every 2 weeks offers possibilities for improving efficiency through its use.

3. Under a 1,500-gallon standard a tank may be loaned to most farmers having a tractor and either a car or a truck. If this minimum were raised, all three would be required by many farmers to qualify for a tank, and it might be difficult to meet competitive practices in loaning equipment.9/ This, of course, does not justify the present standards from an economic standpoint, but it is a factor to take into consideration.

Storage For the Peak Requirements of a 2-Week Period

To serve patrons consistently on an organized route system at regular 2-week intervals, it is necessary that patrons generally have sufficient storage capacity to hold their peak requirements for a 2-week period. Otherwise, the route system will break down in the rush seasons. This would apply especially to patrons located some distance from the bulk plant or those off main roads to which extra deliveries would entail considerable extra mileage. This guide for determining the size of equipment to loan appears to be a more accurate standard than the annual volume purchased by the patron, although there would usually be a close relationship between the two and both should be used. It would mean, however, that the annual volume purchased by the relatively steady user with a 270-gallon tank would be considerably greater than that of the most seasonable user with the same size tank. In fact, a steady user

9/ Surveys by the Bureau of Agricultural Economics, U. S. Department of Agriculture, in 1940 showed the annual consumption of fuel per tractor to be 790 gallons in Delaware; 670 gallons in Maryland; and 660 gallons in Virginia. This has no doubt increased in recent years. Data are not available on average consumption per farm car and truck, but it probably is not as great as that by tractors.

with two or three barrels may purchase more fuel in a year than a seasonal user with a tank. Of course, there will be a number of borderline cases where an extra trip or two would be cheaper than the installation of a tank large enough to handle the peak requirements for only one 2-week period.

During 1943-44, the association with the greatest monthly variation in gasoline volume distributed about 14 percent of its fuel during the peak month of May.10/ If two deliveries of 200 gallons each are made into a 270-gallon tank during May and they represent 14 percent of the total, the annual volume for the year would be 2,857 gallons. During the 3-year period, under study, the highest monthly percentage for any association was 16 percent in May 1942 for the association at Frederick, Maryland. If two deliveries of 200 gallons each in 1 month represented 16 percent of the total, the annual volume would be 2,500 gallons. Two deliveries of 250 gallons each during the month would represent 3,125 gallons per year.

These peak percentages were the average for all patrons. No doubt, purchases by patrons with tanks would show greater seasonal or monthly variation. However, if purchases of 400 gallons in May represented 20 percent, the annual total would be 2,000 gallons; and if 500 gallons were 20 percent, the annual total would be 2,500 gallons.

If such a standard for loaning equipment is logical, then a large number of tanks on farms are not being used efficiently. Since 56 percent of the patrons with 270-gallon tanks purchased less than 1,500 gallons of gasoline and kerosene in 1942-43; 69 percent purchased less than 1,800 gallons; and 87 percent purchased less than 2,500 gallons (see table 15), a smaller size tank (175-200 gallons) would seem to be advisable for such patrons. However, in the past these small tanks have cost almost as much as 270-gallon ones, hence the larger were used. Therefore, under such conditions, the covering of present routes every 3 weeks instead of every 2 weeks appears to offer possibilities for improving efficiency. If the present trend toward more use of mechanized equipment continues, increased fuel consumption of present patrons with 270-gallon tanks will improve the status of such equipment.

The use of the 2-week peak requirement of fuel means that the patron's purchases and consumption over 2 or 3 months of highest seasonal use must be analyzed. If such records are not available, it should be less difficult to estimate peak 2-week requirements than annual requirements. Records on nearby patrons having similar operations would aid in making estimates. The annual volumes, of course, are important, and such records should be summarized each year. Some may be irregular patrons while others may have purchased little if any fuel after the peak season. From such data, the average relationship between the peak requirements

10/ This association was at Fairfax, Virginia, and the percentages for all months were as follows: July, 9.3; August, 7.4; September, 8.6; October, 7.8; November, 7.1; December, 5.9; January, 7.0; February, 6.5; March, 7.8; April, 7.7; May, 13.9; and June, 11.0.

for a 2-week period and the annual volume could be determined so that both could be used in establishing standards for loaning equipment.

In any case the loaning of above ground or skid tanks would be preferable to underground tanks as the cooperative could easily make changes in equipment at the end of the year if the patron's performance indicated this to be advisable.

Effect on Delivery Efficiency

One of the main advantages of loaning equipment is that it enables the association to place equipment where it will save extra trips by the tank trucks. Proper farm storage is essential if trucks are to operate on regular routes and if mileage and delivery expenses of the trucks are to be kept to a minimum. It is difficult to measure the savings on delivery expenses which result from loaning equipment unless cost records have been kept both before and after such a practice was adopted; and then this is affected by other changes, such as size of truck tank or frequency of covering routes, which are usually made when equipment is placed on farms. All associations in this study have always loaned equipment so no comparisons could be made with nonloaning periods or associations. Some indication of its value may be obtained from the experience of an Ohio cooperative which not only began loaning equipment but made other changes in its delivery equipment and practices.11/

Some of the factors to be taken into consideration in evaluating the effects on delivery expense of loaning equipment are the following:

1. Doubling the storage capacity on farms will not reduce mileage of tank trucks 50 percent unless the size of the truck tank also is doubled. However, it will save mileage by reducing the number of trips into each farmstead and it will save considerable time for the farm serviceman. For instance, if 8 men on a route each can be delivered 200 gallons once every 2 weeks instead of 100 gallons every week, 2 tank-truck loads of 800 gallons will be required in either case, but only 8 trips into farmsteads and 8 transactions will be required instead of 16..

11/ The Clinton County Farm Bureau Cooperative Association, Wilmington, Ohio, late in 1940 loaned farmers over $4,000 worth of storage equipment; changed from three trucks with 650-gallon tanks to two trucks with 1,000- and 700-gallon tanks equipped with pumps and meters at a net cost of $1,400; and changed from 1-week to 2-week deliveries. As a result, delivery costs were reduced from 8.63 percent per dollar of business in 1940 to 6.12 percent in 1942 (29 percent) which resulted in transportation savings of $5,392 during the 2-year period. This was about equal to the cost of the new equipment and it was equivalent to 0.3 cent per gallon of fuel handled. Furthermore, gallons delivered per mile increased from 11.9 in 1940 to 19.9 in 1942, an increase of 68 percent. Although annual overhead expenses were increased by costs of loaning equipment, the amount (possibly $600) was small in comparison with savings in delivery expense.

2. Improvements in delivery efficiency will vary depending upon the requirements of patrons on a route or in a community. For instance, considerable saving would result in a case where there are seven patrons on a route each of whom have three drums; six of them each require 100 gallons every 2 weeks, but the other 1 requires 200 gallons during the same period. By placing a 270-gallon tank on the farm of the larger user an extra trip to his farm a week later is eliminated and 800 gallons is dispensed on the route instead of 700 gallons.

3. The most saving in delivery expense can be made by the placing of tanks on farms located the farthest from the bulk plant. It is here that delivery costs per gallon are highest. Using an average total delivery cost of 20 cents per mile, which was approximately the amount in 1943-44, the cost per gallon for delivering 800 gallons various distances would be as follows: a round trip of 10 miles = 0.25 cent; 20 miles = 0.50 cent; 30 miles = 0.75 cent; 40 miles = 1.00 cent; and 50 miles = 1.25 cents per gallon.

Most territories of the cooperatives were more or less circular and extended about 25 miles from the centralized bulk plant. The entire area of such a territory is 1,964 square miles, and one-half of the area is more than 17.7 miles from the plant.12/ If the radius is 20 miles, then one-half the area and patrons, if they are evenly distributed, is more than 14.1 miles from the plant. Increasing the radius from 20 to 25 miles (25 percent) increases the total area from 1,257 to 1,964 square miles, or about 56 percent. Therefore, if the average distance of patrons is 15 miles from the bulk plant, savings in delivery costs should greatly exceed loaning costs of $5.06 per year for a 270-gallon tank.

It is recognized, however, that the location of patrons cannot be used as a standard or basis for loaning equipment, especially while not all oil companies use it or make any differential in delivery charges based upon distance of patrons from bulk plants. Also, those patrons nearest the plant could present a strong case for a tank upon the basis of low cost of delivering fuel to their farms. While it is easy to justify loaning tanks to certain patrons in locations where large savings in delivery expense and time would result, a more definite guide or basis is desirable for general use. A standard based upon annual and peak 2-week volumes, with the effect on delivery efficiency always considered, would seem practical for cooperative associations.

Suggestions Regarding the Loaning of Equipment

The following recommendations regarding policies for loaning farm-storage equipment represent the views of managers in some cases and those of the writer in others. It was recognized that it would be difficult to put some of them into effect among patrons already borrowing equipment on a

12/ The area of a circle varies with the square of its radius (Pi x R_2); thus 3.1416 x 625 = 1,963.5 square miles. One-half of this area is 982. miles; and this divided by 3.1416 = 312.5 miles, of which the square root is 17.7 miles.

different basis, but it was believed that such policies could be used in future loaning operations - especially by new associations.

1. While most managers felt that cooperatives would have to loan equipment to meet competition, some believed that this was not necessary if members were shown the expenses of such practices, and that it was more equitable for the individual to own the equipment than for all patrons to supply additional capital for the cooperative ownership of it. Therefore, in starting a new association it was suggested that consideration be given to selling storage equipment to farmers. The provision that patronage refunds would be applied on the purchase price or that perhaps 1 cent per gallon be added to each purchase until the equipment was paid for could be used.

2. If it is necessary for the cooperative to provide equipment, then the use of a small rental fee may be considered. A charge of one-fourth or one-third of a cent per gallon should cover annual costs depending upon the volume put through it.

3. Cooperatives should loan only tanks and pumps and sell the drums to farmers. This would avoid the accounting for and loss of numerous small pieces of equipment.

4. If it is necessary to loan equipment, cooperatives should consider loaning skid tanks, or standard above-ground tanks without skids. Although the initial cost would be a little more for skid tanks, the tanks could be moved easily and at much less cost than underground tanks. They would enable the association to readily change the size of a tank on a farm to fit the patron's consumption. Disadvantages of such tanks would be slightly heavier shrinkage and more danger of fire as compared with underground tanks. The writer believes it would be highly advantageous for cooperatives to change to the above-ground tanks - especially for loaning to tenant farmers.

5. If it is necessary to continue loaning underground tanks, then the farmers should purchase the tanks and the cooperative loan the dispensing pumps. This would reduce the cooperative's investment by about half and would eliminate the need for removal of tanks in case patrons' consumption declined below minimum standards. Under such a policy, cooperative employees should help obtain the landowner's consent to install equipment on his farm and also aid the tenant with the installation.

6. The peak fuel requirement of a regular patron for a 2-weeks period should be used as a standard or guide for determining the size of equipment to loan as well as the annual volume of the patron. The yearly volume, of course, is important and affords an easy way of checking the use made of equipment at the end of the year.

7. Considering such factors as annual loaning costs; peak requirements of patrons during intervals at which routes are covered; the cost and use that can be made of drums; savings effected in delivery expense and time; and standards used by other cooperatives in the East, it appears that the standard for loaning a 270-gallon tank should be raised

to 1,800 or 2,000 gallons and that for a 550-gallon tank to 3,600 or 4,000 gallons. This would mean that a 175- or 200-gallon tank would be more applicable to those patrons purchasing from 1,200 or 1,500 gallons to 1,800 or 2,000 gallons per year. However, such a tank and pump was not considered practical so long as it cost almost as much as the 270-gallon equipment.

8. If the 1,500-gallon minimum is continued for use of the 270-gallon tank because of its cost relationship to a smaller tank and because total handling costs per gallon were very reasonable under present standards, then the covering of routes every 3 weeks instead of every 2 weeks offers possibilities for improving delivery efficiency.

OPERATING RESULTS AND FINANCIAL STATUS OF THE COOPERATIVES

Operating and financial progress made by the petroleum cooperatives included in this study during the 1942-44 period are discussed in this section. Efficient and regular service was provided in spite of wartime conditions and the various difficulties encountered.

Dollar Volume and Quantities of Products Handled

Dollar Volume Purchased by Patrons

The dollar volume of purchases by patrons increased from an average of $94,514 per association in 1941-42 to $112,266 in 1942-43, an increase of 18.8 percent (see table 18). In 1943-44, volume averaged $119,880 per cooperative which was an increase of 6.8 percent over the preceding year and a 26.8 percent increase over 1941-42. These volumes included that of individual patrons, service agencies and stores, fuel used in association trucks, and a small amount transferred to other cooperatives. Also, the data included gasoline taxes. The range in volume among associations in 1943-44 was from $69,979 to $155,127; however, only one handled less than $100,000. The volume of the three-truck associations averaged $144,947 and the two-truck ones averaged $115,663 in 1943-44.

Gasoline volume represented about 80 percent and kerosene and fuel oil about 12 percent of total volume each year. However, fuel oil and kerosene constituted 32.5 percent of the volume of the association at Fairfax, Virginia, in 1943-44, thus reducing the proportion of gasoline to 57.2 percent. In the remaining nine associations, gasoline averaged 82.2 percent and kerosene and fuel oil 9.8 percent of the total. Motor oil represented about 4.5 percent of dollar volume each year with little variation among associations. The average prices paid per gallon by patrons for refined fuels and motor oil and the effect of volume on operating costs per gallon are shown in a later part of this section.

Other merchandise, including grease and antifreeze, represented about 3.5 percent of dollar volume each year. The amount ranged from $2,891 to $8,371 per association and represented from 2 to 4.5 percent of total volume in 1943-44.

Table 18 - Average dollar volume of business of 10 petroleum cooperatives during fiscal years ended June 20-30, 1942-44

Items	1941-42	1942-43		1943-44	
	Amount	Amount	Percentage of total	Amount	Percentage of total
	Dollars	Dollars	Percent	Dollars	Percent
Gasoline	-	90,028	80.2	94,614	78.9
Kerosene and fuel oil	-	13,458	12.0	15,319	12.8
Motor oil	-	4,759	4.2	5,526	4.6
Other merchandise	-	4,021	3.6	4,421	3.7
Total	a/ 94,514	112,266	100.0	119,880	100.0

a/ Distribution not available.

Quantities of Products Handled

Patrons purchased an average of 567,198 gallons of gasoline per association in 1943-44 compared with 513,162 gallons in 1941-42, an increase of 10.5 percent (see table 19). Kerosene volume increased more than 50 percent and fuel oil gallonage averaged 42 percent more in 1943-44 than in 1941-42. Thus, total gallonage of refined fuels and motor oil increased from 623,844 to 728,502 gallons per association, or 16.8 percent during the 3-year period. The range in total volume handled per association in 1943-44 was from 385,284 to 1,055,817 gallons. The quantity handled by the three-truck associations averaged 939,531 gallons, and that by the two-truck ones averaged 680,192 gallons in 1943-44. Total gallonage of light fuels in 1943-44 was equivalent to 20.1 times the average capacity of the bulk plant storage tanks. Grease, antifreeze, fly spray, and spark plugs showed large increases in volume during the 3-year period. Declines occurred in tires, tubes, batteries, and grease guns.

Table 19 - Average quantities of products handled by 10 petroleum cooperatives during fiscal years ended June 20-30, 1942-44

Items	Units	Fiscal years ended June 20-30			Percentage change - 1942 to 1944
		1942	1943	1944	
Gasoline	Gallons	513,162	539,500	567,198	+ 10.5
Kerosene	Gallons	60,438	88,951	92,589	+ 53.2
Fuel oil	Gallons	42,671	49,140	60,573	+ 42.0
Motor oil	Gallons	7,573	7,657	8,142	+ 7.5
Subtotal	Gallons	623,844	685,248	728,502	+ 16.8
Grease	Pounds	3,300	3,872	4,727	+ 43.2
Transmission oil	Gallons	283	352	361	+ 27.6
Antifreeze	Quarts	989	2,189	1,939	+ 96.1
Fly spray	Quarts	29	2,095	1,180	-
Tires	Number	133	84	117	- 12.0
Tubes	Number	58	37	30	- 48.3
Spark plugs	Number	117	138	217	+ 85.5
Batteries	Number	13	13	11	- 15.4
Grease guns	Number	32	23	24	- 25.0
Miscellaneous	Items	225	169	249	+ 10.7

Table 20 - Motor oil-gasoline, kerosene-gasoline, grease-gasoline, and grease-motor oil ratios for 10 petroleum cooperatives, 1941-42 to 1943-44

Year	Gallons of motor oil per 100 gallons gasoline	Gallons of kerosene per 100 gallons gasoline	Pounds of grease per 100 gallons gasoline	Pounds of grease per 100 gallons motor oil
1941-42	1.48	11.78	0.64	43.58
1942-43	1.42	16.49	.72	50.57
1943-44	1.44	16.32	.83	58.01

Table 20 shows the improvement that has been made during the last 2 of the 3 years in the ratios of kerosene and grease to the gasoline handled. The associations were under the standard of at least 2 gallons of oil per 100 gallons of gasoline. The average of 0.8 pound of grease per 100 gallons of gasoline and 58 pounds per 100 gallons of oil was only about one-half as much as the bulk stations in some sections of the country handled. Computations were not made on fuel oil, as only one association handled it extensively.

It should be noted that cooperative feed and supply stores and agencies in the area also handled some oil and grease, and that some agencies and stores which were supplied fuel by the petroleum cooperatives handled a small volume of oil and grease in relation to gasoline.

There was less seasonal variation in purchases of gasoline in this area than in most midwestern sections of the country. Usually, from 9 to 10 percent of the total gallonage was purchased each of the months from April to July, inclusive; and from 6 to 7 percent was purchased during the period November to March, inclusive (see figure 14). In other words, the large volume months were about 125 percent above average and the low ones about 75 percent below average, with the exception of May which was approximately 150 percent above average in 2 of the 3 years. Purchases during August, September, and October were slightly above average.

Figure 15 in a later section shows the monthly purchases of gasoline, kerosene, and fuel oil by patrons of the association at Fairfax, Virginia, during 1943-44. Large kerosene and fuel oil purchases during the winter dovetail well with the lower gasoline volume during the period.

Gross Margins and Shrinkages

Gross Margins

The gross margin taken per dollar of volume, before shrinkage, increased from 13.39 percent in 1941-42 to 16.25 percent in 1943-44 (see table 21). After deducting shrinkage, the realized gross margin averaged 12.80 percent in 1941-42; 14.27 percent in 1942-43; and 15.96 percent in

1943-44.13/ The margin per association in 1943-44 was about 58 percent greater than that in 1941-42. The range in margins among comparable associations in 1943-44 was from 12.74 to 19.78 percent. Other income, consisting mostly of wholesale commissions, equipment adjustments, and miscellaneous items, increased the gross margin less than one-tenth of a percent each year.

Table 22 shows the gross margins, before and after shrinkage, for the principal fuels during the last 2 years. The improvement in total margins was due mainly to the increase in gasoline margins which averaged 12.83 percent per dollar, after shrinkage, in 1942-43 and 15.00 percent in 1943-44 on gasoline distributed at an average price of approximately 16.7 cents per gallon, including tax, each year.14/ This was equivalent to 2.14 cents and 2.49 cents per gallon for the 2 respective years. The margin in 1943-44 was approximately 23 percent per dollar of gasoline, exclusive of taxes. The range in 1942-43 was from 2.08 to 2.99 cents, and in 1943-44 from 2.22 to 3.32 cents per gallon, exclusive of the association at Staunton which had a margin of 1.42 and 2.06 cents per gallon for the 2 respective years.

The increase in gasoline margin in 1943-44 was effected by wider margins actually taken and by a reduction in shrinkage. This increase (averaging 0.35 cent per gallon) was largely due to O.P.A. regulations permitting all oil companies to charge 1 cent per gallon more on purchases under 200 gallons in amount. Some lowered this minimum to 100 and 150 gallons.

The gross margin per gallon obtained on gasoline by these associations is lower than that obtained by most cooperatives of like character in the United States, with the exception of those in Ohio and certain areas of Kansas and Oklahoma. Cooperatives in many areas realize 3 cents per gallon which is equivalent to 20 percent per dollar on gasoline selling at 15 cents per gallon. When computed on a per dollar basis, a margin of 13 to 15 percent appears exceedingly low. This is due to the higher cost per gallon; higher gasoline taxes; and the fact that most of it is regular

13/ Gross margins of all petroleum associations affiliated with Southern States have declined sharply since 1939-40 when they averaged 21.5 percent, after including shrinkage adjustments and refunds from the wholesale. In 1940-41, the margin was 17.1 percent and in 1941-42 it averaged 14.7 percent, figured on a comparable basis. This reduction was attributed mostly to higher costs to the local associations for products rather than to a reduction in gross margins per gallon taken by them.

14/ State and Federal taxes on gasoline totaled 5 1/2 cents per gallon in Delaware and Maryland. The average price paid by cooperative patrons in those States in 1943-44 was 16.09 cents per gallon. Taxes in Virginia and West Virginia totaled 6 1/2 cents per gallon, and the average price paid in 1943-44 was 17.79 cents per gallon.

Table 21 - Condensed average operating statements of 10 petroleum cooperatives for fiscal years ending June 20-30, 1942-44

Items	1941-42		1942-43		1943-44	
	Dollars	Percentage	Dollars	Percentage	Dollars	Percentage
Total purchases by patrons	94,514	100.00	112,266	100.00	119,880	100.00
Cost of purchases by patrons	81,859	86.61	95,771	85.31	100,400	83.75
Gross margin on purchases	12,655	13.39	16,495	14.69	19,480	16.25
Inventory shrinkage	563	.59	470	.42	345	.29
Adjusted gross margin	12,092	12.80	16,025	14.27	19,135	15.96
Other income and adjustments	8	-	47	.04	58	.05
Total gross income	12,100	12.80	16,072	14.31	19,193	16.01
Operating expenses	11,723	12.40	13,817	12.30	15,226	12.70
Net operating savings	377	.40	2,255	2.01	3,967	3.31
Wholesale savings a/	2,894	3.06	3,375	3.00	4,074	3.40
Total net savings	3,271	3.46	5,630	5.01	8,041	6.71

a/ Includes patronage refunds and dividends on capital stock from Southern States Cooperative, and also wholesale refund adjustments in 1942 and 1943.

grade whereas considerable third-grade gasoline is used by farmers in the middle West. Because of this narrow margin, cooperatives in these eastern States must operate efficiently if they are to remain in business.

Margins on kerosene and fuel oil combined averaged slightly more than 20 percent on the dollar and approximately 2 cents per gallon both years. The average price paid for the two fuels was 9.7 to 10 cents per gallon. The gross margin on motor oil, after shrinkage, averaged 11 cents per gallon (17.7 cents per dollar) in 1942-43. The average price paid by patrons was 62.2 cents per gallon. The margin in 1943-44 was 12.2 cents per gallon (17.9 cents per dollar) and the average price was 67.9 cents per gallon. Margins on miscellaneous merchandise and grease averaged 18.1 percent in 1943-44 compared with 22.2 percent the previous year.

Table 22 - Average gross margins realized per dollar and per gallon of petroleum products, before and after shrinkage, by 10 petroleum cooperatives during fiscal years ended June 20-30, 1942-44

Items	Gross margin per dollar			
	Before inventory shrinkage		After inventory shrinkage	
	1942-43	1943-44	1942-43	1943-44
	Percent		Percent	
Gasoline	13.24	15.23	12.83	15.00
Kerosene and fuel oil	20.72	20.98	20.37	20.57
Motor oil	18.54	18.67	17.67	17.93
Miscellaneous	22.42	18.74	22.16	18.12
Total	14.69	16.25	14.27	15.96
	Gross margin per gallon			
	Cents		Cents	
Gasoline	2.21	2.53	2.14	2.49
Kerosene and fuel oil	2.02	2.10	1.98	2.09
Motor oil	11.52	12.67	10.98	12.17

Table 23 - Average shrinkages of specified products handled by 10 petroleum cooperatives during fiscal years ended June 20-30, 1942-44

Items	Shrinkage as a percent of gallons or units purchased by patrons			Shrinkage as a percent of dollar volume purchased by patrons		
	1941-42	1942-43	1943-44	1941-42	1942-43	1943-44
Gasoline	0.7	0.5	0.3	-	0.41	0.23
Kerosene and fuel oil	0.5	0.4	0.4	-	0.35	0.41
Motor oil	0.6	1.1	1.0	-	0.87	0.74
Other merchandise	-	-	-	-	0.26	0.62
Total	-	-	-	0.59	0.42	0.29
Grease	+ 0.3	0.8	0.8	-	-	-
Transmission oil	-	1.5	2.4	-	-	-
Antifreeze	1.2	+ 0.6	1.6	-	-	-
Fly spray	-	0.1	0.2	-	-	-
Miscellaneous items	+ 2.5	5.2	7.2	-	-	-

Shrinkage

A reduction in shrinkage or inventory shortage from 0.59 percent of dollar volume in 1941-42 to 0.29 percent in 1943-44 has aided the cooperatives in realizing wider gross margins (see table 23). This improvement has been effected mainly by the reduction in gasoline shrinkage, including temperature adjustments, from 0.7 percent of total gallonage distributed in 1941-42 to 0.3 percent i 1943-44. Kerosene and fuel oil averaged 0.4 percent; motor oil, 1.0 percent; and grease, 0.8 percent in 1943-44. A marked increase occurred in shrinkage of miscellaneous items during the 3-year period. Separate records on temperature adjustments and on other losses should help in controlling inventory shrinkages.

The managers of these cooperatives stated that prices of all fuels are kept in line with those of competitors. They did not foresee any possibility of obtaining wider margins in the future. While these associations have grown to their present size under conditions of narrow margins, small net savings, and no patronage refunds paid in cash to members, it is suggested that they endeavor to obtain as wide margins as possible in the future. This will permit greater net savings for use in retiring indebtedness, for expansion, or for the payment of cash refunds. Usually the strongest local cooperatives are those which take reasonably wide margins and pay large patronage refunds.

Operating Expenses

Total operating expenses of the associations averaged $15,226 in 1943-44 compared with $11,723 per association in 1941-42, an increase of 30 percent (see table 24). However, as a percentage of dollar sales volume, these expenses remained almost constant - 12.4 percent in 1941-42 and 12.7 percent in 1943-44. The range among associations was from 10.34 to 15.76 percent in 1943-44. Direct expenses increased from 7.3 to 8.8 percent of dollar volume during the period, but indirect expenses declined from 5.1 to 3.9 percent per dollar.

Table 24 - Average operating expenses of 10 petroleum cooperatives for fiscal years ended June 20-30, 1942-44

Item	1941-42		1942-43		1943-44	
	Amount	Percentage of dollar volume	Amount	Percentage of dollar volume	Amount	Percentage of dollar volume
	Dollars	Percent	Dollars	Percent	Dollars	Percent
Direct expenses:						
Salaries and wages	3,826	4.05	5,304	4.72	6,304	5.26
Traveling expenses	443	.47	282	.25	306	.26
Miscellaneous supplies and expense	259	.27	267	.24	353	.29
Telephone and telegraph	167	.18	221	.20	243	.20
Postage	93	.10	143	.13	136	.11
Stationery and supplies	132	.14	129	.11	134	.11
Heat, light, and power	70	.07	89	.08	87	.07
Truck expense	1,653	1.75	2,110	1.88	2,565	2.14
Delivery service	85	.09	3	a/	115	.10
Advertising	45	.05	34	.03	26	.02
Meeting expense	52	.05	68	.06	120	.10
Fuel oil service	20	.02	-	-	1	a/
Maintenance of loaned equipment	69	.07	47	.04	138	.12
Cash shortage	4	a/	10	.01	-	-
Bank exchange	2	a/	4	a/	17	.02
Collection expense	8	.01	9	.01	8	.01
Equipment inventory shrinkage	14	.02	-	-	-	-
Accident expense	-		-	-	5	a/
Withholding tax expense	-		-	-	-	-
Total direct expense	6,942	7.34	8,720	7.76	10,558	8.81
Indirect expenses:						
Insurance	329	.35	446	.40	476	.40
Rent	7	.01	27	.02	18	.02
Depreciation	2,130	2.25	2,217	1.98	1,912	1.59
Taxes and licenses	391	.41	488	.43	602	.50
Bad debts (allowances)	240	.25	223	.20	166	.14
Accounting and management	591	.63	736	.66	796	.66
Interest on capital	1,093	1.16	960	.85	698	.58
Total indirect expense	4,781	5.06	5,097	4.54	4,668	3.89
Total Operating Expense	11,723	12.40	13,817	12.30	15,226	12.70

a/ Less than 0.005 percent.

Salaries and wages constituted the largest expense item. They represented 32.6 percent of total expenses in 1941-42, 38.4 percent in 1942-43; and 41.4 percent in 1943-44. They increased about 65 percent during the period - more than any other item. As a percentage of dollar volume they were equal to 4.1, 4.7, and 5.3 percent for the 3 respective years. The range was from 3.96 to 6.42 percent in 1943-44. Truck expenses (exclusive of depreciation, insurance, and interest) were next in size. They increased from 1.75 percent to 2.14 percent of dollar volume during the 3 years. Total delivery costs were discussed in a previous section of this report. Depreciation declined from 2.25 percent to 1.59 percent and interest on capital declined from 1.16 percent to 0.58 percent per dollar of volume during the period.

As would be expected, there was a close relationship between volume of business and expenses per dollar each year. It appears that these associations must handle about $100,000 of business if expenses are to average between 12 and 14 percent, and at least $120,000 if expenses are to average between 10 and 12 percent. Little difference existed in expenses per dollar for those handling between $120,000 and $150,000 of volume. Almost all those handling from $55,000 to $85,000 had expenses above 15 percent.

The one-truck plant was least efficient each year. It was recommended that each plant begin operating with at least two trucks, as one truck cannot handle enough volume in relation to the overhead expenses of a plant.

Variations existed in expenses per dollar of business among some of the associations handling similar volumes. For instance, in 1943-44 expenses of one cooperative handling $155,127 were 14.34 percent, or $4,034 greater than those of another whose expenses were 11.89 percent on $153,175 of volume. Most of this difference was due to salaries and wages with telephone and telegraph, maintenance of loaned equipment, insurance and taxes and licenses accounting for the balance. Among the four associations handling from $120,000 to $130,000 worth of business, the expenses of one ran as high as 14.16 percent, from $3,976 to $5,459 more than those of the other three whose expenses ranged from 10.34 to 11.58 percent. This difference was due mainly to truck expense, delivery service, and salaries and wages, with insurance and depreciation making up the balance. These data indicate the importance of expenses on net savings and final costs of supplies to patrons, and the possibilities of improving efficiency by careful analysis of expenses each year.

Handling Costs Per Gallon

On the basis of applying total expenses to the total gallonage purchased by patrons, the handling cost per gallon averaged 1.88 cents in 1941-42; 2.02 cents in 1942-43; and 2.09 cents per gallon in 1943-44. (This basis of computation is quite accurate because more than 96 percent of the dollar volume of business consisted of liquid fuels and motor oil each year). The range among associations in 1941-42 was from 1.46 to 2.92 cents, and in 1943-44 from 1.91 to 2.86 cents per gallon. In this latter year, 5 of the 10 cooperatives had costs ranging from about 2.1 to 2.2 cents per gallon.

These data and those on expenses per dollar of volume indicate that gasoline margins alone have not been adequate to cover expenses and show reasonable net savings until 1943-44. Furthermore, they indicate the importance of handling other fuels and merchandise.

There was a close relationship between handling costs per gallon and total gallonage per association, particularly in 1941-42. It appeared that at least 600,000 gallons should be handled if costs were to be kept below 2.0 cents per gallon in 1941-42, and below 2.2 cents per gallon in 1942-43 and 1943-44.

Net Savings

The net operating savings of the associations, exclusive of savings received from the wholesale, averaged $377 per association, or 0.4 percent per dollar in 1941-42; $2,255, or 2.01 percent in 1942-43; and $3,967, or 3.31 percent in 1943-44 (see table 21). A saving of 3.3 percent on gasoline at 16.7 cents per gallon would be 0.55 cent per gallon. This shows the value of gross margins if reasonable net savings are to be realized. When wholesale patronage refunds and dividends on capital stock from Southern States Cooperative were added, total net savings averaged $3,271, or 3.46 percent, in 1941-42; $5,630, or 5.01 percent, in 1942-43; and $8,041, or 6.71 percent, in 1943-44.

Total net savings of the local associations have been distributed approximately as follows: (1) As dividends on capital stock at the rate of 6 percent, which represented about 5 percent of net savings; (2) as patronage refunds, most of which were paid in capital stock, which represented about 68 percent of net savings; and (3) as allocated operating and working capital reserves, which accounted for the remaining 27 percent of savings.

Assets and Liabilities

The financial condition of the associations has greatly improved during the last 3 years (see table 25). Assets have increased 18 percent and members' equity represented 40.2 percent of total assets in 1944 as compared with 10 percent in 1942. There were $1.03 of current assets per $1.00 of current liabilities in 1944 compared with 40 cents in 1942. Average inventories were turned 28 times in 1944; 26 in 1943; and 20 times in 1942. Dollar volume of business was 5.1 times the cost value of fixed assets in 1944 compared with 4.5 times in 1942.

Net receivables from patrons for merchandise represented only 25 percent of current assets as compared with 32.6 percent 2 years earlier. While the average amount of gross receivables has changed little during the period, on June 20-30, 1944 they represented only 3.1 percent of the current year's total dollar volume of business, while in 1941-42 they were equal to 4.0 percent of the volume. When quarterly averages of gross receivables were compared with total volume of business, receivables were turned 36 times in 1943-44; 32 times in 1942-43; and 22 times in 1941-42. This was equivalent to an average of 9, 10, and 14 days' volume of business outstanding for the 3 respective years. At the close of the 1943-44 year, approximately 88 percent of the accounts receivable were less than 30 days old as compared with 78 percent for the previous year.

Credit Policy

All associations included in this study did credit business, which was estimated to range from one-half to two-thirds of the total volume. The usual credit terms were 30 days which was equivalent to two deliveries or fills, and no further deliveries were made if payment was not made within the 30 days. Some patrons were limited to credit on only one

delivery and others were denied any credit. Monthly statements were mailed to all patrons who were usually slow in paying their bills. As indicated, these associations have kept credit extension under control. Actual bad debt losses have been very small in most cases. The restriction of credit to one or two deliveries and the follow-up facilitated by the regular routes were factors in keeping extra travel for collection work and outstanding receivables at a minimum.

Table 25 - Average statements of financial condition of 10 petroleum cooperatives as of June 20-30, 1942-44

Items	Fiscal years ending June 20-30			Change - 1942 to 1944
	1942	1943	1944	
Assets	Dollars	Dollars	Dollars	Percent
Current assets:				
Cash on hand and in bank	2,413	2,692	3,620	+ 50.0
Accounts receivable - patrons	3,745	3,794	3,680	- 1.8
Notes receivable - patrons	a/ 22	-	a/ 27	-
Less: Reserve for losses	341	513	630	+ 84.7
Net receivables	3,426	3,281	3,077	- 10.2
Miscellaneous receivables	141	519	767	+ 444.0
Merchandise inventory	4,516	3,920	4,838	+ 7.1
Total current assets	10,496	10,412	12,302	+ 17.2
Deferred charges:				
Prepaid insurance, taxes, supplies	297	418	608	+ 104.7
Investments:				
Capital stock - S.S.C.	1,105	4,040	6,142	+ 455.8
Notes receivable - stockholders	99	78	-	-
Total investments	1,204	4,118	6,142	+ 410.5
Fixed or capital assets:				
Buildings and equipment - cost	21,103	22,897	23,289	+ 10.3
Less: Depreciation reserve	3,923	6,304	7,919	+ 101.9
Net fixed assets	17,180	16,593	15,370	- 10.5
Total assets	29,177	31,541	34,422	+ 18.0
Liabilities and Members Equity				
Current liabilities:				
Accounts payable - S.S.C. advances b/	22,938	18,019	10,004	- 56.4
Accounts payable - trade creditors	1,672	3,837	789	- 52.8
Accrued salaries, taxes, etc.	282	479	261	- 7.5
Dividends payable	1,144	1,142	442	- 61.4
Reserve for truck repairs	114	113	104	- 27.8
Reserve for tires and tubes	96	140	319	+ 232.3
Reserve for income tax	-	c/ 116	-	-
Total current liabilities	26,246	23,846	11,919	- 54.6
Deferred liabilities:				
Noncurrent advances - S.S.C. b/	-	-	8,667	-
Members equity:				
Capital stock outstanding	1,284	4,809	7,368	+ 473.8
Reserve for patronage refunds	-	-	1,853	-
Reserve for working capital	-	1,009	2,719	-
Operating reserve	1,647	1,877	1,896	+ 15.1
Total members equity	2,931	7,695	13,836	+ 372.2
Total liabilities and members equity	29,177	31,541	34,422	+ 18.0

a/ Only one association had notes receivable from patrons for merchandise in 1942 and 1944.

b/ All advances from Southern States Cooperative were classified as current liabilities until 1944 when part were changed to deferred or noncurrent liabilities.

c/ Only one association had such a reserve in 1943.

POSSIBILITIES AND PROBLEMS OF EXPANDING PETROLEUM SERVICE

The size and success attained within a few years by these petroleum cooperatives indicates that concentration on the delivery of petroleum products from bulk stations to farms is a sound basis on which to establish them. Farmers apparently were in need of an efficient and regular delivery service. Representatives of the association believed that in organizing new cooperatives in this or similar areas, a bulk plant and at least two tank trucks are the proper facilities with which to begin operation.

Naturally, the question of expansion arises. What are the possibilities of expanding the business along the present lines? What other fuels might be handled or delivered? Should the handling of more types of automotive accessories and services be considered? Should a service station be operated? As the associations become stronger, will members expect them to provide additional services? In what ways can the associations render more efficient and more complete service to a greater number of users of petroleum products in their areas? These problems should be taken into consideration when the present cooperatives make plans to remodel or rebuild their present facilities or acquire new ones in the future. Furthermore, there is also the problem, of how to provide petroleum service to small users in other areas served by the Southern States Cooperative where the cost of delivering fuels would be relatively high.

With reference to the possibility of increasing volume along present lines, each of the associations had a large number of prospective patrons and a potential volume of business in its present territory. Practically all planned to add at least one additional tank truck as soon as possible. Most managers believed they should have at least three trucks; several planned to operate four; and two believed they should eventually have five trucks each.

Most gasoline handled was of regular grade. Six associations had handled ethyl gasoline prior to the war, but practically all had been unable to get such supplies during the war. Managers stated that competitive conditions and changes in motors may compel all distributors to handle this type of fuel in the future. It did not appear that it would be necessary to handle third-grade gasoline, tractor fuel, or distillate in this area.

Handling Fuel Oil

Only the association at Fairfax was handling any considerable volume of fuel oil. In 1943-44, it handled 371,282 gallons of which 368,902 gallons was delivered by trucks. The volumes delivered that year by each of four trucks were 283,449, 47,953, 24,850, and 12,650 gallons. Gallonages of fuel oil handled by the other associations were as follows: Dover, 36,890; Cockeysville, 81,417; Frederick, 23,967; Westminster, 13,342; Martinsburg, 24,753; Fredericksburg, 29,566; Staunton, 24,514 gallons; and Bel Air and Gaithersburg, none. Usually one truck handled most of the volume in each of these associations.

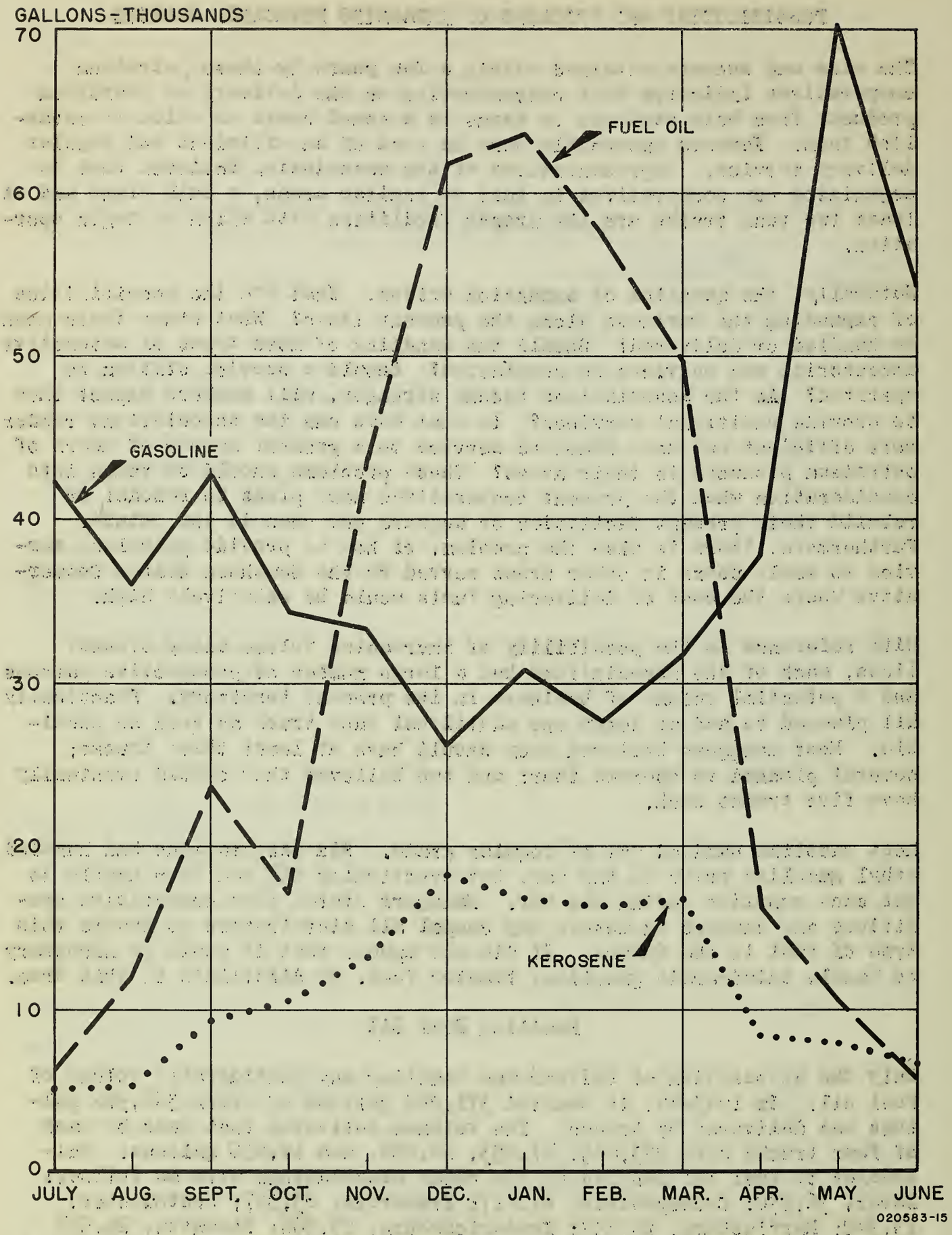


Figure 15. - Gasoline, kerosene, and fuel oil delivered by trucks of the Southern States Fairfax Petroleum Cooperative, Fairfax, Va., July 1, 1943, to June 30, 1944.

Opinions varied among managers as to the advisability of handling fuel oil after the war. Four were favorable to developing this type of business; however, one stated that he did not feel justified in handling fuel oil unless the gross margins could be widened. In the spring of 1944, he was getting only 1 cent per gallon margin while 1-3/4 cents was considered necessary to cover the cost of operation. One manager definitely plans to expand fuel oil business after the war and hopes to have one truck devoting full time to fuel oil and kerosene. Others pointed out that a successful fuel-oil business depends upon the extent to which such fuel was used in the area, the number of city or urban users, and the cost of coal or natural gas. For instance, it was stated that the price of fuel oil was 2 to 3 cents per gallon higher at Staunton than at Fairfax, while the price of coal at Staunton was only about one-half the price at Fairfax. Under these conditions, however, the cooperative at Staunton did have a small fuel-oil business and was in need of more bulk-plant storage.

The cooperative at Fairfax, was among the associations having the lowest expenses per dollar of business and handling costs per gallon of fuel. Its handling costs were 1.46 cents in 1941-42 and 1.72 cents per gallon in 1942-43 - the lowest of the 10 associations studied for both years. The average for all associations was 1.88 cents per gallon for 1942-43 and 2.02 cents per gallon for 1943-44. In 1943-44, its costs were 2.11 cents compared with the average of 2.09 cents per gallon for all associations. Net savings per dollar at Fairfax were considerably higher than at any of the other associations, with the exception of 1 in 1943-44, but this was mainly due to wider margins on gasoline rather than to lower expenses per dollar of business.

According to reports from the associations interviewed, the principal advantages of handling fuel oil are: (1) It helps to provide a larger and more uniform volume of business throughout the year for the cooperative. Figure 15 indicates how it dovetails with gasoline volume thus making possible more efficient year around use of trucks. (2) Margins realized on fuel oil help to pay truck and overhead expenses, thus reducing unit costs of operation on all products handled. However, margins averaged from one-tenth to four-tenths cent per gallon less than that realized on gasoline the past 2 years. And (3) some managers indicated that it was more satisfactory to handle kerosene and fuel oil with the same truck than kerosene and gasoline; also, that handling two grades of gasoline did not affect delivery efficiency as much as did kerosene and gasoline by the same truck.

Problems which might arise from extensive handling of fuel oil are:

1. A considerable portion of the fuel oil probably would be used by nonproducers of agricultural products. It would probably exceed 15 percent of the total farm supply purchasing volume, which is the maximum amount of such business which may be done with persons who are neither members nor producers by income-tax-exempt associations. However, the loss of exemption should not be serious if patronage refunds are declared to all fuel oil patrons and paid in cash. It is understood that under the procedure followed by the Bureau of Internal Revenue that an association

must make provision for the payment of patronage refunds in its organization papers and that the board of directors of the association must declare such dividends before the end of the tax year if such refunds are to be deducted in computing the income taxes to be paid. It may be that procedure could be developed under which the nonproducers would take nonvoting stock for the purpose of assisting in the financing of the fuel-oil business. While present associations have only voting stock, it is planned to have both voting and nonvoting stock in future associations.

2. Should fuel-oil business with nonmember nonproducers constitute more than 50 percent of the total purchasing business, the association would no longer be a farmers' cooperative eligible to borrow funds from the district banks for cooperatives of the Farm Credit Administration. (Eligibility requirements include among other things that the value of nonmember business in a purchasing association shall not exceed the value of member business, and associations must restrict substantially all of their voting stock to producers of agricultural products). Compliance with State cooperative laws must also be taken into consideration. Most of them have substantially the same provisions with respect to member and producer business as the Farm Credit law; however, the Virginia cooperative law provides that, in addition to the 50 percent limit on nonmember business, the value of purchases made for persons who are neither members nor producers shall not exceed 15 percent of the value of all its purchases. These problems may not be encountered in some associations as the amount of fuel-oil business with both producers and nonproducers in the association at Fairfax, Virginia, constituted 32.5 percent of the dollar volume and 35.1 percent of the gallonage of all products handled in 1943-44.

3. Most nonproducer patrons would probably be content to share in the net savings without a vote in the association; however, the problem of permitting them to have voting privileges might eventually arise. Also, there is the further question of whether they should be required to provide capital on the same basis as members.

Handling Accessories and Adding Service Stations

As mentioned in the forepart of this report, the principal accessories and automotive supplies handled by the cooperatives were tires, tubes, batteries, spark plugs, oil filters, grease guns, antifreeze, and miscellaneous items. The dollar volume of all merchandise, including fly spray and grease, averaged only $4,021 and $4,421 per association in 1942-43 and 1943-44, respectively, and represented only 3.6 and 3.7 percent of the total volume during those respective years. Most of these supplies were delivered by farm servicemen. Specially designed display compartments on trucks proved to be of great value in merchandising such items.

It is evident that many possibilities exist for increasing the volume of automotive and miscellaneous supplies without sacrificing delivery efficiency of liquid fuels, and that they can contribute considerable gross margin with little extra expense. For instance, the association at Fairfax, Virginia, handled $8,372 of merchandise in 1943-44 on which the gross margin was $1,624, or 19.4 percent. Fly spray was an important

item in this volume. Also, data on the association at Leesburg, Virginia (which was not among the 10 cooperatives studied in detail) showed that it handled $8,527 of miscellaneous items during the 9 months period ending March 31, 1945, on which a gross margin of $1,754, or 20.6 percent was realized. Grease and fly-spray volumes were relatively higher than in most associations.

In making postwar plans for enlarging and remodeling the facilities of the associations, it appears that more display space and service facilities would result in a much larger volume of automotive supplies. For instance, it was mentioned that space and equipment for changing tires, repairing tubes, and charging batteries would aid in handling such items. Some managers also believed they should have facilities for greasing association tank trucks.

It has not been the policy of these petroleum cooperatives to operate service stations. Only the cooperative at Bel Air has a regular service station. It is located on a main highway leading into the city and is adjacent to the Southern States Cooperative feed and supply store. The bulk station facilities are located at the rear of the service station. The manager believed that a volume of at least 4,000 gallons per month was necessary to break even. In May 1943, their volume was only 5,035 gallons compared to 12,492 gallons in May 1941, before rationing.

Five associations had curb pumps, but only a small amount of fuel was distributed through these pumps. Managers of the associations with facilities located on main highways were generally favorable to adding a service station after the war. Several managers of associations with bulk plants located along the railroad and away from a highway were unfavorable to service station operation. Some questioned the advisability of having a station because of the competition of better located private stations and the narrow margins available on retail operations.

It is the opinion of the author that the bulk plant set-up renders a more needed service to farmers than would service stations and that it is the soundest basis on which to establish petroleum cooperatives in this area. However, it should be pointed out that as cooperative associations become well established and financially strong, members often desire that they render additional services or handle more commodities. In view of the fact that in the area studied there were 93 farm automobiles and 27 trucks compared with 23 tractors per 100 farms in 1940, farmers may eventually expect to have their cars and trucks serviced through their cooperatives. On the basis of an annual consumption of 400 gallons of liquid fuel per farm car, 400 gallons per farm truck, and 800 gallons per tractor, the annual motor fuel requirements for 100 farms would be 37,200 gallons for cars and 10,800 gallons for trucks compared with 18,400 gallons for tractors. However, a large part of the fuel used by the cars and trucks no doubt would be purchased in bulk from tank trucks delivering to the farms.

Farm petroleum cooperatives in the Midwest (with the exception of most of those in Illinois, Indiana, and Ohio) generally have standard type service stations as well as bulk plants, and some were getting modern or

super-service stations before wartime rationing began. Many carried a rather wide variety of automotive supplies, farm supplies, and hardware items. However, the situation with respect to general farm supplies is different in the area included in this study as they are handled by other Southern States service stores and agencies in the same territory. Thus, any service stations operated by petroleum cooperatives likely would be limited to the handling of automotive supplies or accessories in addition to motor fuels and service work. Furthermore, the same problems might be encountered in dealing with nonproducer patrons of service stations as when fuel oil is handled on an extensive scale.

Serving Outlying Territories

The entire territory of each cooperative included in this study is served from one centralized bulk plant. This practice is in line with that used by cooperatives in New York, Pennsylvania, Ohio, and Indiana; and by part of those in Illinois.15/

As mentioned, most cooperatives in this study supplied fuel to several private dealers (service agencies) and service stores of Southern States Cooperative. They operated curb pumps and provided fuel at regular retail prices. Usually their storage consisted of 550 or 1,000 gallon tanks. These service agencies and stores made it possible for the petroleum associations to increase their volume; they provided an additional service to patrons; and they served as dumping stations for extra fuel remaining on the tank trucks at the close of a trip or a day. However, they generally did not have sufficient storage to permit trucks to refill and continue on their routes in that vicinity.

The Petroleum Management Service is considering the use of a four or five compartment trailer of perhaps 1,000 gallons capacity for use in serving the most distant routes. As the tank truck goes to the far end of a route to start delivering, the trailer would be left at a point on a good road where the truck would most likely need to refill. Later in the day the truck would obtain its second load of fuel from the trailer. One trailer per association will be rotated among the farm servicemen. It appears that its use should result in the saving of much mileage and time by tank trucks that would otherwise have to go back to the bulk plant to refill.

After the war, it is suggested that a few cooperatives experiment with a junior or branch bulk plant in the more distant section or sections of their territories. The tanks could be of relatively small size if the plants are served by transports. One or possibly more farm servicemen

15/ In the heavier fuel-consuming areas of Illinois, there are from two to five bulk plants in a county association with one to three trucks operating from each plant. Some of the outlying plants are often larger than the central or headquarter's plant. In the lighter fuel consuming counties and in the Indiana counties, there is one centralized plant in a county association. In other midwestern States, an association may have one or two sub-bulk plants and/or service stations in other towns.

would be located at this plant to serve the surrounding territory. Such plants should result in much saving of mileage and delivery expense. It is the opinion of the writer that a territory or route extending not to exceed 12 to 15 miles from the bulk plant would result in more efficient operations than the 20 to 30 mile territories after taking into account the added investment, expense, and disadvantages of the branch plant. It is recognized that volume is not sufficient in many cases to revise territories and install branch plants in all associations on this basis. One plant might first be tried in a good territory which extends some distance from the central plant. Installing it at perhaps 20 miles from the head office would permit the farm serviceman to serve a territory extending 8 miles toward the central plant, and perhaps 10 to 15 miles each of the other directions, or an oblong territory of roughly 400 square miles.

It is believed that a branch plant under the direction of a local farm serviceman would be preferable to one supervised by a service store or agency from which trucks would refill when farm servicemen were serving that area. However, it is possible that such a bulk plant might be operated to advantage on a retail or dock station basis by a service agency located at the junction of the territories of three petroleum cooperatives. Much mileage could be saved by farm servicemen using it when they needed a second load of fuel for far ends of their territories. It is quite possible, however, that the use of trailer trucks will be a more satisfactory method of servicing outlying territories than the establishment of branch plants.

Serving Areas of Small Motor Fuel Consumption

The present petroleum bulk plants are located primarily in northern Maryland and northern Virginia where the use of tractors is most prevalent (see figure 2). In the other sections of these States and also in parts of West Virginia and Kentucky, there are many patrons of Southern States service stores and agencies who have either tractors, trucks, or automobiles. Some, of course, are relatively small users of fuel. How to provide these patrons with an efficient petroleum service is a difficult postwar problem because of the high cost of operating a delivery service in an area of small or scattered users.

It appears that there are sufficient tractors, cars, and trucks for the development of a petroleum delivery service in most Maryland counties. All but 2 had 0.5 or more tractors per square mile in 1940. In Virginia, however, only 23 of the 101 counties had 0.5 or more tractors per square mile and most of these were in the northern and southeastern part of the State. West Virginia had only 6 of its 55 counties with this number of tractors, while Kentucky had only 30 of its 120 counties and Tennessee had 14 of its 95 counties with 0.5 or more tractors per square mile.

While a minimum of five-tenths tractor per square mile may not be one of the correct standards to use in determining the establishment of bulk plants, all petroleum cooperatives now in operation in Virginia serve areas which equaled or excelled that number in 1940. The total farm trucks and automobiles either may use as much fuel as the total

tractors in some areas, but usually the sections with a small tractor population also had a relatively small number of farm trucks and cars. Certainly the number and use of all three should be analyzed in determining future plant locations.

In attempting to develop a satisfactory petroleum service for these areas of small farm consumption of motor fuel, it is suggested that a few "pilot" plants be established along the following lines:

First, in the areas of heaviest mechanized farming, a petroleum cooperative might be set up on the "come-and-get-it" or dock station basis. Under such a system farmers would haul their own fuel and purchase it at perhaps 1 to 1 1/2 cents per gallon under the delivered price. Purchases in small amounts for cars or trucks at the plant would be made at regular retail prices. It would be of much advantage to the petroleum cooperative and a convenience to farm patrons for such a plant to be located near a Southern States service store or private service agency. Also, it might be desirable for such a station to supply other service stores and private agencies in the territory with petroleum products. Furthermore, one tank truck might be operated on regular routes to serve the larger patrons who have 270-gallon or 550-gallon tanks and the service agencies and stores. If there appeared to be good prospects for developing a fuel oil business, two trucks might be operated by the association.

Second, a combination bulk and service station set-up might be organized wherein the large underground tanks would serve as both bulk and service station storage. Delivery service or come-and-get-service or both might be provided and the service station operations and accessories should provide considerable revenue for the associations.

Third, in areas having the least amount of mechanized farming and large users of motor fuel, a bulk plant might be operated as a department of a Southern States service store or agency. The petroleum products probably would need to be handled entirely on a "come-and-get-it" basis in such cases. Cars and trucks could be served from retail pumps, and accessories, tires, batteries, and other items handled at the station. Another postwar possibility may be self-service community stations equipped with coin or token meters for specific quantities.

The operation of petroleum cooperatives on a "come-and-get-it" or dock station basis is most prevalent in western sections of the country where farms are large and far apart and delivery costs are relatively high. Most petroleum cooperatives in Montana and Texas operate on such a plan and have a combination bulk plant and service station. Also, some cooperative elevator associations in western Kansas and Oklahoma operate petroleum dock stations in connection with their other business. However, in eastern Wisconsin where diversified and dairy farms are quite dense, there are some general farm supply cooperatives which operate "come-and-get-it" or dock stations and retail pumps. The volumes of refined fuels handled by 4 of these Wisconsin associations in 1943 ranged from 275,000 to 450,000 gallons per association. The counties served with the exception of 1, however, had from 3.5 to 4.1 tractors per square mile in 1940, and farm expenditures for petroleum products ranged

from $112 to $133 per square mile in 1939. One county had only 1.3 tractors and $79 of petroleum expenditures per square mile. There were approximately 33 trucks and 105 automobiles per 100 farms in these counties.

Advantages of the "come-and-get-it" method were given as follows: (1) A saving of the delivery cost can be made by farmers hauling their fuel at the same time that they come to town weekly to get their feed and groceries; and (2) it aids in increasing the volume of business in all departments of a general farm supply association.

Difficulties of the plan were: (1) Some farmers prefer delivery service rather than the savings which result from hauling their own fuel; (2) some patrons do not have satisfactory equipment for hauling drums or facilities for unloading them at their farms; (3) some farmers haul their fuel during slack seasons but want delivery service during busy seasons; and (4) competitors may deliver fuel to the larger users at near dock station prices.

Although the Wisconsin cooperatives mentioned above operated in an area having many more tractors than the Virginias and Kentucky, the number of trucks and automobiles on farms and the possibility of an increase after the war in general purpose tractors in these States are important factors to be considered. Therefore, in developing a petroleum service for such patrons in areas where topography and road systems are not favorable to low cost deliveries, it appears that the "come-and-get-it" plan should be given consideration.

SUMMARY AND CONCLUSIONS

This study covers the operations of 10 local farmers' petroleum cooperatives located in Delaware, Maryland, West Virginia, and Virginia. These associations, formed from 1938 to 1941, are affiliated with Southern States Cooperative, Inc., Richmond, Virginia, which provides them with wholesale purchasing and management services. They deliver to farms practically all of their volume which consists primarily of regular gasoline, kerosene, motor oil, grease, and small quantities of automotive supplies. Only 1 organization operated a service station and only 1 handled fuel oil extensively. All supplied fuel to a number of Southern States service stores and agencies who then retailed it to patrons. Each cooperative served a territory extending 20 to 25 miles each direction from its centralized bulk plant.

The study indicates that these cooperatives have made remarkable progress since organization and that they are providing petroleum services to farmers on an efficient basis, considering the conditions under which they operate. There are possibilities, however, for further improvement in efficiency, service, and growth.

The Petroleum Management Service of the wholesale contributed greatly to the successful and efficient operation of these associations. Assistance was given in management, accounting, membership and employee relations,

and educational activities. Much of this progress has been due to the educational program for employees. More programs of this type for directors should be beneficial.

Significant points of the study and postwar suggestions for further improving efficiency were as follows:

1. The use of motorized equipment on farms, although rapidly increasing, was not as great in the area served by these cooperatives as in many sections of the country. In 1940, there were an average of 23 tractors per 100 farms, or only 1.0 tractor per square mile of all land; and 27 trucks and 93 automobiles per 100 farms. The diversified farming in the area, however, resulted in a more even consumption of motor fuels throughout the year. The range was from about 6 percent of total volume in January to 14 percent in May in 1943-44.

2. Much of the area served was rolling to hilly with some level and some mountainous. Improved roads radiated from the cities in which the bulk plants were located, but many followed valleys with few cross roads connecting them. This situation and the need for some type of a farm lane improvement program were factors retarding delivery efficiency.

3. The cooperatives were serving the small as well as the large farmers. During the year 1942-43, 57 percent of the 624 patrons per association (exclusive of stores and agencies) each purchased less than $100 worth of products and their combined volume represented 13 percent of the total. However, 26 percent of all patrons purchased less than $25 worth each. Perhaps the volume of this group might be increased and mileage in serving them reduced by making larger deliveries and fewer trips to their farms. At the other extreme 5 percent of the patrons each purchased $500 worth or more and their volume was 28 percent of the total. Purchases of all patrons averaged $152 with the range from $109 to $209.

4. The average volume handled per association in 1943-44, was $119,880, an increase of 27 percent over 1941-42. Regular gasoline represented about 80 percent; kerosene and fuel oil, 12 percent; motor oil, 4 percent; and automotive supplies and grease, 4 percent of the dollar volume. The average quantity of light fuels and motor oils handled was 728,502 gallons per cooperative, an increase of 17 percent during the period. Gasoline volume, however, increased only 10.5 percent. Motor oil gallonage was 1.44 percent of gasoline volume in 1943-44 compared with 1.48 percent in 1941-42; and kerosene was 16.3 percent compared with 11.8 percent for the two respective periods. An average of 0.83 pound of grease per 100 gallons of gasoline and 0.58 pound per gallon of oil in 1943-44 was an improvement but still relatively low. Some oil and grease, however, was handled by cooperative service stores and agencies in the area.

5. Gross margins, after shrinkage, averaged 15.96 percent per dollar of business in 1943-44 compared with 12.80 percent in 1941-42. This was the result of improvement in gasoline margins and of reduction in shrinkage. The margin on gasoline, after shrinkage, averaged 2.49 cents per gallon in 1943-44 compared with 2.14 cents the previous year. Shrinkage

on gasoline was greatly reduced. It was only 0.3 percent of the gallonage distributed the last year compared with 0.7 percent 2 years earlier. Shrinkage on all products averaged 0.29 percent per dollar of business in 1943-44 compared with 0.59 percent in 1941-42.

6. The high degree of efficiency of the association was indicated by their operating or handling costs. They averaged 12.7 percent per dollar of business in 1943-44 compared with 12.4 percent in 1941-42. Such costs were equivalent to 1.88; 2.02; and 2.09 cents per gallon for the years ending in June, 1942-44, respectively. Salaries and wages were 5.3 percent of dollar volume and 41.4 percent of total expenses in 1943-44. A volume of 600,000 gallons was usually necessary if handling costs were to be kept below 2.2 cents per gallon the last 2 years. Costs were high each year in the one-truck plant because of insufficient volume in relation to overhead expenses.

Obtaining a larger proportion of the potential volume in the territories served should further reduce handling costs per unit. Some associations, however, should carefully analyze their expenses as there was a variation in handling costs of $4,000 to $5,000, or 2 1/2 to 3 1/2 percent per dollar, among some cooperatives handling similar volumes and types of business.

7. Net savings on local operations were 3.3 percent per dollar of business in 1943-44 compared with 0.4 percent in 1941-42. After adding wholesale savings, total net savings averaged 6.7 and 3.5 percent per dollar for the 2 respective years.

Members' equity in the associations increased from 10 percent of total assets on June 20-30, 1942 to 40 percent on the same dates in 1944. Total assets averaged $34,422 per association on June 20-30, 1944, an increase of 18 percent during the 3 years. Net receivables from patrons for merchandise constituted 25 percent of current assets on this date and these receivables represented about 9 days' volume of business in 1943-44. Average inventories were turned 28 times in 1943-44 and dollar volume of business was 5.1 times the cost value of fixed assets.

8. An average of 22 full-time farm servicemen and tank trucks in the 10 associations in 1943-44 delivered an average of 308,441 gallons of fuel per truck compared with 314,479 gallons for each of 16 trucks in 1941-42. These are very high volumes considering the area and conditions under which they operated. In 1943-44, the volume per truck ranged from 200,175 to 385,736 gallons, exclusive of a fuel oil truck which delivered 443,096 gallons. The 5 high volume trucks each delivered more than 345,000 gallons. As a standard, it appears that trucks in the area should deliver at least 275,000 gallons; all except 5 exceeded this volume in 1943-44. Mileage per truck was reduced from 19,082 miles in 1941-42 to 15,885 miles in 1943-44, a decline of 17 percent. The addition of 6 trucks to serve about the same territory was mainly responsible for the reduction in volume and mileage of trucks in 1942-43. A larger volume was then handled in 1943-44 on about the same mileage by better planning of routes; by covering routes every 3 to 4 weeks in the winter; by eliminating call-backs; and by encouraging minimum deliveries of 25 gallons each.

9. Delivery efficiency was stepped up from 16.5 to 19.4 gallons delivered per mile of travel during the 3-year period, an increase of 17.5 percent. This is an exceptionally good record for trucks in this area. The range in 1943-44 was from 13.7 to 29.8 gallons per mile, exclusive of the fuel oil truck which delivered 34.1 gallons per mile. The five high trucks exceeded 22 gallons while the low five delivered less than 17.5 gallons per mile. It appears that trucks should deliver 18 gallons per mile with 22 to 24 gallons as a good standard at which to aim.

Main factors causing variation in delivery efficiency were size and shape of area covered by trucks; percentage of potential farm volume handled; density of patrons and tractors; size of users; number of service stores and agencies supplied; organization of routes; topography and road systems; and changes in farm servicemen and variations in their abilities.

10. Total delivery costs were very low considering the area served. Before allocation of a part of salaries to general expenses, delivery costs averaged 0.9, 1.0, and 1.1 cent per gallon for the years ending June 20-30, 1942-44, respectively. After such allocations, they averaged slightly more than three-fourths of a cent per gallon the first 2 years and nine-tenths of a cent in 1943-44. Furthermore, delivery costs of 1.1 cents per gallon represented 52.4 percent of the total handling costs of associations and they were equivalent to about 6.7 percent per dollar of business handled in 1943-44. On the basis of an assumed salary of $1,800 per year for all farm servicemen, total delivery costs would have averaged from 1.0 to 1.1 cents per gallon each year. Delivery costs decreased about one-tenth of a cent per gallon with each 2 gallons increase in "gallons delivered per mile of travel".

Truck operating expenses, including interest paid on truck investment, averaged approximately one-half cent per gallon each year, but they increased from 8.0 cents per mile in 1941-42 to 9.8 cents per mile in 1943-44, mainly because of repairs, tires, and tubes. Trucks averaged 7.4 miles per gallon of gasoline used the last 2 years. Farm servicemen's salaries averaged 0.5 to 0.6 cent per gallon each year; and after allocating part of them to general expenses, they averaged 0.3 to 0.4 cent per gallon the last 2 years. Further improvement in delivery efficiency should occur when plants become more mature; when more patrons are obtained in a given territory; by the use of larger truck tanks in level areas; as a result of the preventive maintenance program for trucks; by the use of trailers from which trucks would refill; by installing branch or sub-bulk plants; from shorter, more stable routes; and by improvement of roads and farm lanes.

11. One of the important practices contributing to the high degree of delivery efficiency and patronage from farmers was the routing system followed. Well-organized routes were covered every 2-weeks except during the slack winter months when they were made every 4 weeks. Routes were set up on a scientific basis wherein each of the second week's routes were either parallel with or directly beyond those of the corresponding days of the first week. Thus, any patrons needing fuel at the end of

1 week could be served with little extra mileage, and small users of fuel as well as large ones could be served regularly at a reasonable cost per gallon. Deliveries were always started at the far ends of routes.

Route maps with colored strings for each route and pins for each patron; route sheets showing names of patrons on each route; and farm servicemen's truck books which showed purchases of various fuels by patrons on routes and their accounts receivable were important tools used in the route system. It was believed that a farm serviceman could satisfactorily serve 18-20 patrons per day, but if prospects were to be contacted then a total 15 patrons and nonpatrons would be sufficient.

12. Managers listed the following advantages of the route system: It was the only means by which fuel could be delivered to all farms on an efficient basis in this area; it aided farm servicemen in controlling credit; it permitted them to contact prospective patrons and build volume along with the making of regular deliveries; and it facilitated the conducting of membership relations and educational work. Employees stressed that the success of routes depended upon the farm serviceman staying on them and keeping on schedule, and constantly checking and revising them to keep up with changes in patrons, farmers, and volume on routes.

Possibilities for improving efficiency were the serving of more patrons per day and limiting routes to perhaps 15 miles in length, although volume available in an area and the added investment, costs, and disadvantages of branch plants would have to be considered. The covering of routes every 4 weeks in the winter definitely improved efficiency; and in new associations, the establishment of routes on a 3-week rather than on a 2-week basis might be considered, especially if 270-gallon tanks are loaned to patrons.

13. On June 20-30, 1944, one association had four trucks; two each had three trucks; and seven associations each had two trucks. All were owned by the associations and practically all had rated capacities of 1 1/2 tons. A heavy duty 1 1/2-ton truck was considered a satisfactory size for level areas, but a 2-ton truck with a dual rear end was recommended for rougher areas. More road clearance and easier riding qualities were desired. The cab-over-engine type of truck was not favored because of difficulties in handling it on country roads. On July 1, 1944, the Petroleum Management Service established a comprehensive preventive maintenance program for trucks and equipment, although for some time two traveling maintenance men had been provided for servicing the trucks.

Twenty trucks were equipped with 850-gallon tanks and the other four tanks had capacities ranging from 920 to 1,040 gallons. Most tanks had four compartments. Managers favored 850-gallon tanks for the rolling to hilly areas and 1,000-gallon tanks for level areas. All trucks had power take-off unloading pumps and meters. An extra meter and hose for kerosene was favored by some managers.

14. Bulk plants of most associations had capacities ranging from 30,000 to 50,000 gallons with the average 35,811 gallons. Gallonage handled in 1943-44 was 20.1 times the bulk tank capacity. Managers

recommended 20,000 gallons storage for regular gasoline and at least 10,000 gallons each for ethyl gasoline, kerosene, and fuel oil, or a total of 50,000 gallons. All associations were in need of larger warehouse and office facilities. The average investment at cost value in bulk station facilities was $6,276 and in delivery equipment $7,552, or a total of $13,828 per association on June 20-30, 1944. Fixed assets, including loaned equipment, averaged $23,289 per association.

15. An average of 270 gasoline and kerosene patrons per association had petroleum storage equipment loaned to them by the associations. They represented 43 percent of all patrons, exclusive of service agencies and stores, and they purchased 65 percent of the total gasoline and kerosene gallonage. They had an average of $26 worth of equipment per patron. Including equipment held by stores, agencies, and non-patrons, the cost value of all outstanding loaned equipment on June 20-30, 1944 averaged $8,890 per association. Equipment on hand averaged $571, thus making a total of $9,461 per association. The range among associations was from $5,238 to $11,940.

On June 20-30, 1943, 47 percent of the patrons with loaned equipment had less than $30 of such equipment, which represented an average of two 55-gallon drums; 45 percent had $30-$49 of equipment, which consisted of a 270-gallon underground tank and pump; and 8 percent had $50 or more of equipment, which usually consisted of a 550-gallon underground tank and pump.

Minimum annual volume standards used in determining the type and size of equipment to loan were 1,500 gallons of gasoline for 270-gallon tanks; 2,500 gallons for 550-gallon tanks; and 550 gallons of kerosene for 55-gallon drums. These quantities were equal to about $7 worth of business per $1 of equipment.

16. Advantages of loaning farm storage equipment were as follows: It enabled the cooperatives to obtain and maintain an adequate volume of business; it enabled the cooperatives to get all the business of patrons who borrow equipment; and it improved delivery efficiency as equipment of proper size could be placed so that routes could be covered at regular 2-week intervals, thus saving both mileage of trucks and time of farm servicemen.

Disadvantages and problems were as follows: The large investment required; the annual costs of loaning the equipment; the inequitableness of requiring patrons who own their equipment to provide capital for equipment to be loaned to other patrons; difficulties of refusing to loan equipment to small users and of removing underground tanks not used efficiently; problems of getting consent of absentee landowners to install equipment on their farms; and the difficulties of determining standards for loaning equipment on an efficient basis.

17. During 1942-43, the average volume purchased by patrons owning all their equipment was 471 gallons of gasoline and kerosene and $88 worth of all business per patron. The average volume of patrons who had

some loaned equipment was 1,337 gallons and $241 worth of business per patron. This was equivalent to 51 gallons and $9.23 worth of business per $1 of loaned equipment.

During 1942-43, patrons with loaned drums each purchased an average of 775 gallons of gasoline and kerosene and $134 of all business which was equal to 120 gallons and $20.77 per $1 of equipment. The range was from $12 to $26 per $1 of equipment. Patrons with 270-gallon tanks purchased an average of 1,575 gallons of gasoline and kerosene and $285 of business - equal to 42 gallons and $7.51 per $1 of equipment. The range was from $6.71 to $8.80 per $1 of equipment. Patrons with 550-gallon tanks purchased an average of 3,474 gallons and $652 of business - equivalent to 43 gallons and $8.00 per $1 of equipment. The range was from $5.75 to $12.11 per $1 of equipment.

Much of this equipment was not being used efficiently. Fifty-seven percent of the patrons with 270-gallon tanks purchased less than the minimum standard of 1,500 gallons, and one-half of this group purchased less than 1,000 gallons. Likewise, one-half of those with the 550-gallon tanks fell below the 2,500-gallon standard.

18. Annual costs of loaning equipment during 1942-43, including depreciation, maintenance, and interest expense, averaged about $1,139 per association, or approximately one-fourth of a cent per gallon of fuel put through the equipment, and almost two-tenths of a cent per gallon of total volume handled by the associations. Such costs were about 9 percent of total handling costs and equivalent to 1.0 percent per dollar of business. Loaning costs of a 270-gallon tank averaged $5.06 in 1942-43, or 0.32 cent per gallon and 1.8 percent per dollar of business. Similar costs per gallon existed for the larger tanks.

19. It appears that the minimum volume standard for the loaning of a 270-gallon tank should be raised to 1,800 or 2,000 gallons, and that for the 550-gallon tank raised to 3,600 or 4,000 gallons if loaning costs are to be kept down to one-quarter of a cent per gallon; if such costs are not to exceed 10 percent of total handling costs; if annual volume standards are to be correlated with the deliveries that could be made each 2 weeks during the peak month; and if the standards are to be more nearly in line with those used by other eastern cooperatives.

Factors indicating that present standards are satisfactory are the reasonable total handling costs of the associations in spite of the fact that purchases of many patrons with tanks were below the standards; the fact that it is not practical to purchase and loan 175 or 200-gallon tanks at their present costs; and difficulty might be experienced in meeting competition if the higher standards required a farmer to have a tractor and both a car and a truck to qualify for a tank.

20. The peak fuel requirements for a 2-week period should be used as a standard for determining the size of tank to loan as well as annual volumes. Unless patrons have the proper storage for such requirements,

farm servicemen cannot stay on 2-week routes. Use of such a standard would probably result in higher annual volume requirements. Also, the highly seasonal user would require a larger tank than a steady one having the same annual volume.

21. Although difficult to measure, savings in delivery time and expense is one of the principal benefits derived from loaning equipment. Doubling storage capacity on farms will not reduce mileage of trucks by one-half unless the size of the truck tank is also doubled, but it will reduce trips into farmsteads and save time of farm servicemen. The most saving can be made by placing tanks on farms the fartherst distances from the bulk plant as one-half of the area of a circular territory is approximately in the outer one-third of the circle. However, location of patrons cannot be used as a basis for loaning equipment as long as all oil companies do not make any difference in delivery charges based upon distance.

22. Suggestions made by managers regarding the loaning of equipment were as follows: In starting new associations sell rather than loan equipment to patrons if possible; if necessary to loan, then the use of a small rental fee might be considered; sell drums and loan only tanks and pumps; sell the underground tanks to farmers and loan only the pumps; loan skid or standard above-ground tanks rather than underground ones - especially for loaning to tenant farmers; use the peak 2-week requirement of fuel as one of the main standards for determining the size of equipment to loan; raise the present minimum standard for 270-gallon tanks to 1,800 or 2,000 gallons per year, and loan 175 or 200-gallon tanks to those patrons whose annual volumes are from 1,500 to 2,000 gallons, provided the cost relationship of tanks makes this practical; and continue present annual volume standards for the loaning of 270-gallon tanks, and operate routes on 3-week rather than 2-week schedules.

23. Among the possibilities for expansion of petroleum service are the handling of fuel oil and more automotive supplies and accessories. They should result in lower per unit costs of operation and in considerable extra gross margin with little extra expense. However, the volume of business with non-producers might present problems in maintaining an income-tax exempt status of the associations. More display space in offices and additional service facilities as well as display space on trucks should help in merchandising automotive supplies.

24. Efficiency in serving outlying territories of the associations should result from the use of trailer tanks from which trucks would refill while serving the more distant routes. Limiting length of territories or routes to 12 or 15 miles from the bulk plant by use of branch or sub-bulk plants in some of the heavier volume areas should improve efficiency after taking into account added investment, expenses, and disadvantages of such plants.

In areas of small motor fuel consumption where the cost of maintaining a delivery service would be high, it is suggested that a few dock or "come-and-get-it" stations be tried - both as separate associations and in conjunction with existing cooperative service stores and agencies.

Table 26 - Farms, farm land, cropland, kind of roads bounding farms, and farms having telephones in selected counties of four South Atlantic States, April 1, 1940

State and county a/	Number of farms		Average size of farm	Farm land as a percentage of all land	Cropland in 1939 as a percentage of all land b/	Hard surfaced and gravelled roads c/	Farms having telephones
	Total	Per square mile					
	Number	Number	Acres	Percent	Percent	Percent	Percent
Delaware:							
*Kent	2,742	4.6	110	79	43	54	18
New Castle	1,587	3.6	122	69	36	91	42
Sussex	4,665	4.9	86	66	37	46	23
Maryland:							
*Harford	2,269	5.1	91	72	31	73	48
Cecil	1,456	4.1	120	78	39	57	32
*Baltimore	3,737	6.1	64	61	32	79	43
*Carroll	3,188	7.0	81	88	56	43	35
*Frederick	3,466	5.2	100	81	47	52	37
*Montgomery	2,062	4.2	106	69	31	68	49
Howard	1,007	4.0	123	77	38	74	48
West Virginia:							
*Berkeley	1,306	4.1	111	72	34	46	25
Jefferson	859	4.1	142	90	49	84	30
Virginia:							
*Fairfax	1,484	3.6	84	47	15	81	34
Prince William	1,044	3.0	119	56	18	64	29
*Spotsylvania	1,313	3.2	112	56	13	50	10
Stafford	898	3.3	103	53	16	32	10
Caroline	1,800	3.3	111	57	16	49	7
King George	844	4.7	100	74	25	45	d/
*Augusta	3,719	3.7	99	58	22	62	42
Total or average	39,446	4.4	98	68	32	60	32

Source: U. S. Census of Agriculture, 1940.

a/ Counties marked with an asterisk are those in which the headquarters of the petroleum cooperatives are located. The counties not so marked are those into which the trade territories of the cooperatives also extend.

b/ Cropland includes cropland harvested, crop failure, and cropland idle or fallow. Plowable pasture was not included.

c/ Many farms have frontage on more than one type of road. In such cases, they were classified according to the highest or superior type of road recorded for them.

d/ Less than 1 percent.

Table 27 - Gasoline and kerosene patrons with specified amounts of loaned storage equipment on June 20-30, 1943, and proportionate gallonage of fuel purchased by them in 1942-43 from 10 petroleum cooperatives (service agencies and stores excluded)

Classification of equipment by cost groups and location of cooperatives	Number of patrons per association	Percentage of total patrons with loaned equipment	Percentage of total gallonage purchased by patrons with loaned equipment	Average value of equipment		Percentage of total loaned equipment
				Per patron	Per association	
	Number	Percent	Percent	Dollars	Dollars	Percent
Less than $30:						
Dover	161	60	41	6	1,006	17
Bel Air	147	39	19	6	817	8
Cockeysville	153	46	26	6	897	10
Westminster	198	53	36	6	1,174	14
Frederick	160	64	44	7	928	21
Gaithersburg	82	35	15	8	627	8
Martinsburg	102	43	22	9	887	12
Fairfax	57	30	16	12	683	10
Fredericksburg	88	51	21	4	389	9
Staunton	136	51	34	6	868	13
Average	129	47	27	6	827	12
$30 to $49:						
Dover	94	35	45	39	3,620	60
Bel Air	197	52	65	36	7,067	68
Cockeysville	157	47	54	39	6,104	70
Westminster	152	41	51	36	5,499	68
Frederick	87	35	54	39	3,397	76
Gaithersburg	132	56	61	39	5,125	67
Martinsburg	103	44	38	38	3,913	55
Fairfax	111	58	55	35	3,929	60
Fredericksburg	67	39	46	40	2,649	58
Staunton	113	43	51	38	4,244	64
Average	121	45	53	38	4,555	65
$50 or more:						
Dover	13	5	14	109	1,417	23
Bel Air	33	9	16	74	2,437	24
Cockeysville	25	7	19	69	1,734	20
Westminster	21	6	13	71	1,483	18
Frederick	2	1	2	69	138	3
Gaithersburg	22	9	24	89	1,948	25
Martinsburg	30	13	40	79	2,363	33
Fairfax	22	12	29	90	1,970	30
Fredericksburg	18	10	33	82	1,480	33
Staunton	17	6	15	92	1,566	23
Average	20	8	20	81	1,654	23
All groups	270	a/ 100	a/ 100	26	7,036	100

a/ Total gasoline and kerosene patrons with loaned equipment represented 43 percent of all patrons of the associations, and they purchased 65 percent of the total gallonage of gasoline and kerosene.

FORM 2 - COMPARATIVE STATEMENT OF OPERATIONS

_____ PETROLEUM COOPERATIVE

For ____ 194__ and ____ Months Ended ____ 194__ and 194__

	MONTH		YEAR TO DATE		LAST YEAR TO DATE	
	AMOUNT	%	AMOUNT	%	AMOUNT	%
Net Purchases by Patrons—Gasoline						
Gross Margin on Patrons' Purchases—Gasoline						
Net Purchases by Patrons—Fuel Oil						
Gross Margin on Patrons' Purchases—Fuel Oil						
Net Purchases by Patrons—Motor Oil						
Gross Margin on Patrons' Pur.—Motor Oil						
Net Purchases by Patrons—Miscellaneous						
Gross Margin on Patrons' Purchases—Misc.						
Total Net Purchases by Patrons—All Comm.						
Total Cost of Patrons' Pur.—All Comm.						
GrossMargin on Patrons' Pur.—All Comm.						
Inventory Over or Short						
Adjusted Gross Margin						
Equipment Adjustment						
Wholesale Commissions						
Other Savings						
Total Gross Savings						
Expenses—as per schedule						
Net Savings						

OPERATING STATISTICS

	MONTH OF		YEAR TO DATE	
	194	194	THIS YEAR	LAST YEAR
Total Gallonage				
Delivery Cost per Gallon				
Delivery Cost per Mile				
Total Handling Cost per Gallon				

EFFICIENCY FACTORS

	GASOLINE	MOTOR OIL	FUEL OIL	MISCELLANEOUS
Inventory Over or Short—This Month				
Over or Short Percentage—This Month	%	%	%	%
Inventory Over or Short—Year to Date				
Over or Short Percentage—Year to Date	%	%	%	%

ANALYSIS OF MERCHANDISE INVENTORY		FINANCIAL STATEMENT ACCOUNTS	
Gasoline		Balance in Reserve for Truck Repairs	
Fuel Oil		Balance in Reserve for Tires and Tubes	
Motor Oil		Accounts Receivable	
Miscellaneous		Loaned Equipment	

Comments:

020583-16

FORM 3 - COMPARATIVE ANALYSIS OF OPERATING EXPENSES

_____ PETROLEUM COOPERATIVE

For..... 194..... and..... Months Ended..... 194..... and 194....

	Month		Year to Date		Last Year to Date	
Direct Expenses:	AMOUNT	%	AMOUNT	%	AMOUNT	%
Salaries and Wages						
Traveling Expense						
Miscellaneous Supplies and Expense						
Telephone and Telegraph						
Postage						
Stationery and Supplies						
Heat, Light, and Power						
Truck Expense						
Delivery Service						
Advertising						
Meeting Expense						
Fuel Oil Service						
Maintenance of Loaned Equipment						
Cash Over or Short						
Bank Exchange						
Total Direct Expenses						
Indirect Expenses:						
Insurance						
Employees' Pensions and Insurance						
Rent						
Depreciation						
Taxes and Licenses						
Provision for Bad Debts						
Accounting and Management						
Interest on Capital						
Total Indirect Expenses						
Total Operating Expenses						

ANALYSIS OF VOLUME

	Month			Year to Date		
	VOLUME	OVERAGE	SHORTAGE	VOLUME	OVERAGE	SHORTAGE
Gasoline (Gals.)						
Kerosene (Gals.)						
Motor Oil (Gals.)						
Fuel Oil (Gals.)						
Anti-Freeze (Qts.)						
Grease (Lbs.)						
Tires						
Tubes						
Spark Plugs						
Batteries						
Transmission Oil						
Grease Guns						
Spray (Qts.)						
Miscellaneous						

FORM 4 - STATEMENT OF TRUCK PERFORMANCE

_____ PETROLEUM COOPERATIVE

For ..... 194.... and ..... Months Ended ..... 194 ....

STATISTICS FOR THE MONTH

Gallons Delivered:	TRUCK #	TRUCK #		TOTAL
Gasoline				
Kerosene				
Fuel Oil				
Motor Oil				
Total Gallons Delivered				
Miles Operated				
Gallons of Gasoline Used				
Average Mileage Per Gallon				
Gallons Delivered Per Mile				

EXPENSES FOR THE MONTH

	TRUCK #	TRUCK #		TOTAL
Interest, Depreciation, Taxes, and Insurance				
Farm Serviceman's Wages				
Gasoline				
Oil, Grease and Anti-Freeze				
Tires and Tubes				
Repairs				
Delivery Service				
Total Truck Expenses				

STATISTICS FOR THE YEAR TO DATE

Gallons Delivered:	TRUCK #	TRUCK #		TOTAL
Gasoline				
Kerosene				
Fuel Oil				
Motor Oil				
Total Gallons Delivered				
Miles Operated				
Gallons of Gasoline Used				
Average Mileage Per Gallon				
Gallons Delivered Per Mile				

EXPENSES FOR THE YEAR TO DATE

	TRUCK #	TRUCK #		TOTAL
Interest, Depreciation, Taxes, and Insurance				
Farm Serviceman's Wages				
Gasoline				
Oil, Grease and Anti-Freeze				
Tires and Tubes				
Repairs				
Delivery Service				
Total Truck Expenses				

Comments:

020583-18

FORM 5 - DATA ON PROSPECTIVE PATRONS OF PETROLEUM COOPERATIVES

ROAD _____ ROUTE _____

NAME	ADDRESS	Tractors	Trucks	Cars	Est. Gas	Est. Kero.	Est. Fuel Oil	Equipment If Any	Uses	REMARKS

020583-19